A Survey of Transit Agencies on Web-based Feedback Tools and their Role in Addressing Riders

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A Survey of Transit Agencies on Web-based Feedback Tools and their Role in Addressing Riders

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Summary

This thesis presents the results from a survey of transit agencies on web-based feedback tools and their role in enabling communication between agencies and riders. Motivation for the survey stems from the growing importance of web-based feedback tools in improving transit services. Web-based feedback can improve transit agencies' knowledge of issues relating to their systems while enhancing the transit riding experience. As the availability of Internet and smartphones increases among transit users, the tools available to gather feedback have grown in response. Web- and smartphone-based tools are instrumental in collecting a wide range of feedback, including commendations and complaints, maintenance issues, transit services, safety and security, long-term planning and other transit operations related issues. At the same time, transit agencies must determine how to best respond and manage the growing presence of information on the web relating to their agencies performance. Through a web-based survey administered to 130 transit agencies in the United States and Canada, information was gathered on the current and planned use of web-based tools by transit agencies. The overall survey results show that most transit agencies focus on sorting and responding to unsolicited feedback being collected primarily through social media, email, and online forms. Additionally, transit agencies see the benefits of web-based customer feedback, noting that the key to managing their systems into the future will involve developing agency-wide digital feedback plans that allow automation and integration across all feedback channels. Finally, transit agencies also noted that the primary downside to web-based feedback involved a lack of staff resources to support their systems.

This thesis provides further analysis regarding the survey results, focusing on three questions:

- How can agency size, based on unlinked trips, influence the survey responses collected from agencies regarding their use of web-based feedback tools?

- What variables from the survey can influence a transit agencies ability to provide web-based feedback tools to their riders?
- What factors might contribute to differences in transit agencies' rider access estimates to Internet and smartphones?

While the results show that larger agencies are able to offer more web-based feedback tools to their riders, there were problems with transit agencies incorrectly estimating their riders' access to Internet and smartphones. This could cause issues regarding agencies' ability to understand which web-based tools they should implement to engage their riders. This thesis details one portion of an overall project, which will provide a framework for agencies to assess their needs and resources to determine how to create their own effective customer feedback systems in relation to what web-based feedback tools will most benefit themselves and their riders.

Chapter 1 Introduction

Along with the goal of improving the public transit system, there underlies the question of how the public can provide feedback through collective web-based feedback mechanisms. For years, riders did not possess the ability to instantly improve their transit systems through feedback, as hand-written surveys and town-hall meetings don't allow instant access or response. In contrast, the digital age has produced numerous possibilities for how customer voices can be used to enhance transit service. As transit riders increasingly gain access to Internet and smartphones, each individual agency has a greater ability to reach out and understand the specific issues and views that their customers share. If agencies choose not to engage their riders online, they must acknowledge that discussions regarding their performance and image will continue online without them. Online feedback not only presents transit agencies with the opportunity to sway the conversation, but also allows them to reduce the time and costs spent on engaging the public.

Considering the available wealth of web-based feedback tools today, 'best practices' will be established to identify systems that effectively collect, analyze, and respond to web-based feedback for each transit agency. Through these tools, the voices of riders can be used to enhance facility maintenance, address security issues, and improve instant satisfaction among riders through real-time responses. Beyond the instant gratification of web-based feedback lies the ability of riders to shape the future of their transit service by providing opinions on long-term based improvements, expansions, or other projects being suggested to the public.

The core objective of this research is to understand how the current arsenal of web-based feedback tools can be used to collect feedback on multiple elements of the transit system, while also analyzing how these tools are influenced by agencies perception of their ability to collect, analyze, integrate, and disseminate rider feedback. This thesis builds upon the research conducted in the Transit

Cooperative Research Program (TCRP) B-43 paper entitled “Use of Web-based Customer Feedback to Improve Public Transit Services”. The motivation for the report stems from the importance web-based tools play in supporting communication between transit agencies and riders. The survey administered for TCRP B-43 strove to understand what web-based tools agencies use for customer feedback, how the tools are used, and the results agencies are reporting from their usage. This thesis presents the original survey results and then goes beyond the report to address three major questions that grew out of the original survey relating to how various conditions identified by transit agencies can impact their usage of web-based feedback tools now and in the future.

The first question addresses how differences between the size of each transit agency impacts its use of web-based feedback tools. It is hypothesized that larger agencies will have greater usage of web-based tools due to their greater resources, including staff size, funding, and draw for top talent. Additionally, it might be possible that larger agencies in urbanized areas contain more transit riders with access to Internet and smartphones that can utilize such tools. Following-on, the second question will evaluate what other factors affect transit agencies ability to provide web-based feedback tools to their riders. The hypothesis is that agencies estimating more riders having access to Internet and smartphones, and finding greater satisfaction with using web-based feedback tools will use more web-based tools.

The final question seeks to analyze how transit agency estimates for rider access to Internet and smartphones are measured, and how accurately they reflect the actual representation of transit riders with access to both technologies. Since agencies may base their usage of web-based tools off of their riders’ accessibility to them, it is important for them to have accurate knowledge of their riders’ access to technology. If estimates are not up to date, agencies may end up focusing their limited resources on developing tools that are not suitable for their target audience.

The next chapter of this thesis provides background on the web-based feedback tools being used today, as well as the types and categories of feedback that transit agencies typically receive from riders. Following this, chapter 3 will present the current state of the practice regarding web-based tools and feedback, chronicling transit agencies that are using tools innovatively to reach their riders online. Chapter 4 introduces the methodology used for the survey, flowing into a presentation of the results in chapter 5. In addition, chapter 5 will address the three questions proposed using chi-square tests, factorial regression analysis, and comparisons of agency responses. In chapter 6, the discussion will focus on the findings presented, and how the proposed questions from this thesis can be addressed for assessing the future use of web-based feedback tools. This thesis will conclude with chapter 7, presenting the impacts of this thesis on the use of web-based feedback tools by transit agencies.

Chapter 2 Background

This chapter addresses the types of web-based feedback tools available today, as well as the general categories of feedback that transit agencies can expect to receive.

2.1 Current Transit Feedback Issues

Many transit agencies have found that communication between themselves and the public is essential to maintaining a positive relationship with their customers and the broader community (1). Utilizing direct feedback from riders can help transit agencies improve their services to better meet their users' needs. Techniques used to disseminate and gather messages to and from the public vary by both web-based and non-web-based forms, and have been covered in depth in previous web-based studies (1). However, past studies on the techniques used to access and broadcast information from public agencies to the public have focused primarily on non-web-based feedback, implying that there is room for understanding the online interactions between transit agencies and their customers in detail. This analysis will reveal the role of the transit agency and transit customer through key areas of web-based feedback: web-based feedback tools, types, and categories.

2.1.1 Web-based Feedback Tools

The primary need for this analysis brings out the question, what web-based feedback tools should transit agencies use? There are a variety of tools available online today, with more continuing to appear due to the growing popularity of web-based tools. Web 2.0, the second generation of the Internet that allows two-way communication on websites, has already become ingrained in modern culture. Every day, more people are using the web, and as of May 2013, more than 85% of American adults (aged 18 or older) use the internet while another 91% of American adults own cell phones (2,3). Additionally, 58% of American adults have smartphones, with 51% claiming to prefer mobile applications

over web browsers on their phones (3). Projections assume that trends will continue, with the number of people online growing as time goes on, indicating that web-based tools are increasingly essential for reaching out to transit populations for feedback.

It is already understood that web-based feedback methods have the ability to reach broader audiences, while also requiring less time to process feedback received when compared to traditional feedback methods, such as open houses, public hearings, comment cards and customer call centers (4, 5). At the same time, web-based tools have been found to offer significant time and cost savings compared to similar traditional methods by reducing paperwork and employees needed (4).As of September 2012, 41 State Departments of Transportation (DOTs) are using social media (6). As agencies are seeing funds reduced due to government cuts, time and cost saving measures are essential for keeping up with increased passenger demands. Consequently, web-based tools have become increasingly popular with agencies as a means for customer communication.

At this time, there are a variety of methods for obtaining web-based feedback, with the general constraints placed upon each method depending on the transit agencies' desire for solicited feedback or unsolicited feedback, their staffs' ability to implement and maintain web-based tools, and the ability of transit riders to use web-based tools. Clearly, tools such as email and social media gain the upper hand here, as they are quite familiar to the general public, are easy to implement by almost anyone, and can both be used by agencies to receive solicited and unsolicited feedback. However, each tool has its own niche and must be properly analyzed in the context of transit agency feedback to understand how it can be best employed. This section will provide a basic overview of the functions and capabilities offered by different web-based tool types.

Email and Online Forms

Email and online forms are the most common web-based tool. They are usually posted on transit agencies' websites, allowing users to send questions, comments, and concerns to the agency. Though this is an efficient way to receive information, the methods for handling such incoming information generally differ based on the agency. As email is still the most used form of online communication (7), it is important that all agencies continue to utilize this basic form of communication.

Feedback Panels

Panels have traditionally existed in person, where members of the public are asked to form groups that provide feedback on products or services at a forum they physically attend. The emergence of Web 2.0 has now enabled panels to move online, generating greater involvement, faster turnaround times, and lower costs to the agency (8). Feedback panels are efficient at getting feedback from the public, especially when agencies are efficient at recruiting large groups of diverse people.

Online Surveys

Online surveys are used to solicit responses from targeted audiences, as well as the general public. This tool is typically used for feedback rather than market research, though its use as a market research tool is available through TCRP Synthesis 105 (8). Online surveys can be developed in-house or through third-party survey software, and broadcasted to the public through email blasts, website exposure, or media releases. Upon receiving feedback, results can be analyzed immediately by web-based tools themselves, making analysis easy for employees, with less time spent compiling information and distributing surveys.

Social Media

One of the most popular web-based tools in use today, social media has enabled people across the world to connect to other people, businesses, and organizations. Of Americans using the internet, 65% of them are using social networking sites, with adults the fastest growing segments of the social networking population (7). Social networking allows agencies to connect with their users and dispense information quickly, while also allowing users to comment and reply to the agencies.

Crowdsourcing

Crowdsourcing is a great way for agencies to tap into their riders' knowledge, experience, and problem solving skills. Crowdsourcing itself is the art of obtaining services, ideas, and content by soliciting from within large groups. One widely known crowdsourcing application is Wikipedia, where users submit information on vast categories of information to build the largest online encyclopedia in the world. Crowdsourcing focuses less on the agencies input, and more on the user's ability to brainstorm ideas that can help the agency, requiring less employee input once the site has initially been created.

Internet Forums (Online Communities)

Online communities are sites where groups of people with similar goals or interests connect and hold conversations online through discussion sites. These communities can be formed using existing web-based tools, such as establishing groups within social media platforms, or entirely new websites, such as transittalk.probaords.com. Online communities can be established by the public or transit agency. Sites allow people to come together and discuss information pertaining to problems or ideas they have for ways to improve certain features, which can be proposed later to transit agencies. They are primarily created by the users themselves, allowing for little agency control of the topics discussed.

Mobile Applications

Mobile applications (frequently called “apps”) are growing in users, with 91% of Americans owning cell phones, and 58% owning smartphones (9). Unlike mobile websites, mobile apps are native to smartphones, and can allow for in-phone capabilities such as GPS, cameras, and other features to directly feed into the applications. Applications allow users to use the internet while on the move, accessing agency trip planners, real time information sites, and other features that help them travel. Additionally, built in features can allow users to send reports to agencies to let them know of any glitches or problems with the applications or transit system, providing vital real-time feedback.

2.1.2 Web-based Feedback Types

While the tools themselves are essential to collecting, analyzing, and responding to feedback, it is best if agencies also understand what type of feedback they desire. The two primary categories of feedback are solicited feedback and unsolicited feedback.

Solicited feedback is structured by the agency to receive specific information within areas they are interested. Areas include comments and feedback for service and fare changes, customer satisfaction sentiments, or project planning reports. Solicited feedback can result in feedback on a wide variety of traditional and technology-driven platforms, such as web-based surveys and panel discussions.

Unsolicited feedback is less structured, and contains all of the comments, suggestions, and complaints that are submitted by customers on a daily basis. These comments can be submitted on almost all collection channels incorporated by transit agencies, including call centers, email and online forms, written comments, social media, online communities, and mobile applications.

Within these two base types of feedback, the transit agency will find several areas of feedback that are useful for operating their systems. The following list contains commonly reported feedback topics from previous syntheses (1).

Transit service operations detail anything related to the agency's daily services, including late or early buses, crowding, temperature on the vehicle, or customer information needs. Feedback on these topics can help agencies address short-term problems, such as on-time performance issues, where additional capacity is needed, or where additional customer amenities are needed (e.g. schedule information, a shelter, and lighting).

Maintenance issues identify problems with buses, rail cars, and station equipment. This feedback can allow agencies to fix broken heaters or air conditioners on vehicles, locate graffiti on vehicles and facilities, and identify broken elevators, escalators, fare machines, or turnstiles. This feedback is useful for keeping vehicles clean and operating, while also identifying damaged agency property.

Safety and security issues cover safety of particular stops and stations, safety of bus or rail routes, lost and stolen reports, and suspicious people around agency property. Agencies can use this information to know where to increase security patrols to reduce crime on their systems and help their riders feel safe.

Complaints and commendations can help agencies ensure their employees are doing their jobs. This feedback can include reports of distracted bus drivers, lack of customer attention by station clerks, and information regarding poor service. This can also include positive feedback on extraordinary job performances. These comments can help the agency identify employees that aren't providing good customer service as well as identify and reward employees that provide excellent customer service.

Service planning includes short- to medium-term planning for both regular fixed-route services and demand response services for people with disabilities. Feedback in this topic helps agencies identify areas for improvement in terms of service frequency, geographic coverage, and service span.

Policy changes include service standards that outline levels of service to be provided, fare policies, rider rules (e.g. food/drink on the vehicle), park-and-ride rules, and vendor advertising. This feedback allows agencies to understand how its users feel about changes that are made to their commutes, and how convenience can be added to help them on their journeys.

Budget and fare levels constitute an especially important topic in the constrained fiscal environment. Feedback on budget and fares can help agencies communicate fiscal realities and changes in service and fares, and spur "outside-the-box" thinking from customers and the general public for new revenue sources.

Marketing and promotions include advertising for the agency, a service or a route, promotion programs. Feedback from this topic can help agencies better engage the public and assess the effectiveness of the marketing efforts.

Long range and capital planning make an important topic in which understanding customer issues and establishing a collaborating relationship with customers serve as primary goals (1). Feedback for long-range and capital planning can help agencies "get it right" from the beginning and is especially important in building a strong long-term rider-base (1).

The following chapter assesses the state of web-based feedback tools and their systems in relation to their usage, integration, and benefits and drawbacks. It also presented an in-depth assessment on previous research related to the 'best practices' and developing trends in the use of web-based feedback programs.

Chapter 3 Overview of the Practice

3.1 Why Should Transit Agencies Use Web-based Feedback?

The identification of web-based feedback types and tools allows transit agencies to understand the systems currently available to them, but doesn't explore the reasoning behind using them. The benefits and drawbacks associated with using web-based feedback tools will be assessed in this chapter, while also showcasing 'best practices' currently being employed by transit agencies across the United States.

3.1.1 How can Agencies Use Feedback?

There are many procedures for handling feedback among transit agencies. Studies have previously exemplified the importance of having a positive attitude towards using feedback as a pre-requisite to handling feedback. Also, agencies need to acknowledge that non-expert knowledge is itself the act of creating new knowledge, allowing new perspectives to be thrown into the mix. Mixing local knowledge with technical staff knowledge adds value to projects, employing the ideas of those that will be using the systems (10). The literature review presented here reveals three ways in which feedback is used by agencies: customer sentiment analysis, direct action, and customer education.

Customer Sentiment Analysis

Transit agencies can use sentiment analysis to understand the general attitudes towards their services as acknowledged through social media platforms (11, 12). This information monitoring allows agencies to see why certain attitudes are held, giving them time to conduct further research on these findings or create web-based tools that allow them to reach out and engage riders on the situation. For example, the New Jersey Transit System (NJ Transit) ePanel (online panel of riders gathered by NJ Transit to answer solicited questions) on customer satisfaction tracked rail riders sentiment over a

period of time. The feedback was analyzed to help understand why certain rail lines scored poorly, and identified ways for them to improve them based on ideas collected from riders (13). While the feedback can be effective in discovering problems, the process for dealing with those problems may take longer to implement.

Direct Action

The most direct way to use feedback is through direct action. Agencies have the ability to take direct action on many issues, including operations, maintenance, and staff problems. Through applications such as SeeClickFix, which allows users to report municipal issues like potholes or broken street lights, online communities can report problems for the agency to fix via GPS-linked text descriptions or photos. Once the issues have been resolved, the transit agency can respond with images of the fixed problem (14). Such information is unsolicited, yet still requires attention from the agency to let users know they are concerned about the issue, allowing them to establish trust with riders. Applications such as SeeClickFix can depend heavily on the ability of the agency itself to deal with the problem, and the budget they have for such problems.

Customer Education

Another use of feedback can be to educate the agency and riders. Tri-County Metropolitan Transportation District of Oregon (TriMet) used survey results from a Facebook survey to create graphs of user responses to allow users to understand their own general concerns (15). These findings helped the agency understand what its riders were concerned with, as well as educating the riders on issues that others felt regarding services. Education of riders can help transit agencies prevent multiple comments or inquiries into situations such as closures or delays, as long as the agency reacts appropriately and in a timely manner to situations that may arise.

3.1.2 Benefits and Challenges of Using Web-based Tools for Feedback

The benefits and drawbacks associated with web-based tools vary based on which tools are used, as well as how they are used. Therefore, a synthesis of broad benefits and drawbacks associated with the use of such tools will be presented in the following section.

Benefits

Increased Public Participation

Some web-based feedback tools can help to increase participation among under-represented populations. In one example, web-based tools help to decrease intimidation by the presence of agency employees, public interest groups, and other activists by allowing users to submit opinions and ideas online (10). Several agencies also noted that participation in meetings increased when anonymous commenting was permitted online, encouraging users to participate in the public process (16). Web-based tools can also allow the public to participate in sessions at times that are more convenient to them, as well as from locations that benefit them if they are too far away to attend.

Cost Effectiveness

For many web-based tools, such as email, online surveys, and social media, sign-ups are free and little additional work or customization is needed to set up pages. This allows many web-based tools to help agencies engage customers at a low cost (16). Web-based tools can also eliminate the need for employees to conduct on-board surveys, organize panels, and attend meetings in person, saving employees additional time, while permitting on-demand analysis to quickly analyze feedback through web-based tools themselves (17). Web-based tools also disperse information quicker to the public, allowing real time updates concerning delays and problems to reduce the number of riders calling and messaging transit agencies for information regarding such issues(5).

Enhances Agency Image

Web-based tools can also make agencies appear approachable and trustworthy. Just by acknowledging feedback from users and interacting with people online, the trust that the public has in the agency can be enhanced (18). Established trust helps people feel that their opinions are being heard, rather than being ignored or going un-acknowledged. The Daily Pothole, a crowdsourcing application run by New York City, allows drivers to report potholes; city officials keep the public informed as to their progress by submitting photos and descriptions of the fixed problem online. Shortly after the Daily Pothole was started, the city found that more people trusted the agency to help them (19).

Real Time Feedback

Mobile applications and social media are especially well suited for reporting time-sensitive conditions in real time, including safety and security concerns. However, while internet or cellular access may be readily available on the street, connections may be limited or nonexistent in subway stations, tunnels, or remote areas.

Challenges

Negative Feedback

The immediacy of web-based platforms makes it easy for users to connect with public agencies on a range of issues, but sometimes customer comments turn negative. A challenge for agencies is determining how to manage unsolicited or informal feedback that comes through various channels, especially when comments are critical of the agency itself. Researchers at Purdue University documented this experience when they analyzed rider attitudes regarding the Chicago Transit Authority using a sample of Twitter posts, or tweets. Using the technique of sentiment analysis, they concluded that “transit riders are more inclined to assert negative sentiments to a situation than a positive

sentiment" (11). Knowing that they may face rider criticism in the social space has made some transit agencies uneasy about using social media. In a survey of US and Canadian transit operators conducted for TCRP Synthesis Study 99, 60% of responding agencies said that concerns about handling online criticism were "important" or "very important" in their decision to use social media (16). Agencies need guidance on how to harness these powerful tools to solicit positive feedback, including ideas for improving service. However, agencies should understand that not all users will be satisfied, and some issues will remain unfixed. Though several agencies may cite fear of criticism as a reason for not establishing web-based tools, careful interaction can turn negative feedback into useful information (16).

Data Volume, Usefulness and Accuracy

The amount of information that can be sent over the internet can cause what some might describe as information overload. When using web-based feedback tools, defining a process for handling and integrating data is crucial. The increased number of participants in the feedback process is making it easier for agencies to collect feedback from a much larger audience, with the additional advantage of direct contact with their respondents (20). However, increased feedback does not equal useful feedback, and sorting through unsolicited comments, and even solicited comments, to find useful tidbits can be a tedious process that requires carefully designing web-based tools to gather useful information (14, 21, 22).

Additionally, if agencies can't respond to the information received, the public may believe that their ideas are being ignored by the agency. The volume of information being received can easily overwhelm transit agencies, and therefore requires a system in place to categorize, analyze, prioritize, and respond to data. Even then, researches working with Austin's SNAPP project, which used social media to help generate comments and ideas for long range planning projects, concluded that a "further

development of analysis techniques are needed to enable timely reporting that will be most useful to public officials" (17).

This presents a serious challenge for agencies as deciding how many web-based tools they can manage, as the more tools they provide to their riders may increase the amount of information they may potentially receive and be required to categorize, analyze, and respond to. Furthermore, metrics that evaluate whether current web-based feedback tools are meeting users' needs are not yet common and thus agencies are using anecdotal evidence for this purpose (20, 23).

Handling Feedback

Because web-based feedback tools are relatively new, another challenge is presented in ensuring that public comments get integrated into transit operations, maintenance, or planning activities, effectively closing the feedback loop. The website Co.Exist describes how the City of Boston's CitizensConnect accomplishes this:

> Citizens report clogged storm drains, excessive jackhammer noise, illegal trash dumping, and faulty street lights, complete with pictures. Reported cases then go directly into the city's work order queue for resolution, and users are informed how quickly the case will be closed. When cases are resolved the date and time of the resolution is listed, providing users with the sense that the city is on the job (24).

Understanding how agencies integrate web-based customer feedback with agency operations and existing systems is critical to the success of this project. However, many transit agencies may not have existing systems in place for work orders, requiring manual systems to be set up to integrate web-based feedback.

Information Equity

As of May 2013, 85% of adults in the United States use the internet, primarily those in the 18-49 age group (2). Even traditionally underrepresented minority groups use the internet in large proportions. For example, 85% of the Black population uses the internet (2). This suggests that agencies can successfully reach many of their riders through web-based tools. However, there are challenges that remain. Though the ability to tap a large racial and socioeconomic diversity is present, some groups are less likely to use the internet. These include those without high school diplomas (40% offline), those older than 65 (44% offline), Hispanic (24% offline), and those making less than $30,000 in annual household income (24% offline) (2). The challenges will vary by agency, as these percentages are national averages and not necessarily representative of their riders. This potential failure to reach certain demographics, though, can cause agencies to consider the best methods for reaching these groups (1, 16, 13). Discovering which web-based tools these groups use can be a step in the right direction for ensuring equity, enabling transit agencies to ensure feedback from a more representative rider population. Other concerns for diversity remain with those riders lacking proficiency with English and individuals with disabilities who are unable to use web-based tools that haven't been adapted to their needs (1).

If web-based reporting is to become a major form of customer interaction with transit agencies, issues of equity and user access to the Internet present major concerns. Often it is minorities, rural populations, and the elderly that lag behind in technological adoption while these same populations have a higher propensity to use public transit (10). For some populations, text-based options for feedback tools can play a part in ensuring the widest applicability; however the simpler interface of these tools can limit their functionality. Similarly, tools must take individuals with limited English proficiency populations into account. By making use of web functionality, tools can be translated into

multiple languages, but steps must be taken to ensure they are correct when such populations are present. Finally, it is critical that tools are accessible for people with disabilities, including those with visual or hearing impairments and those with mobility or cognitive limitations. Therefore, a functional web-based system must utilize agency resources efficiently to ensure that all segments of the transit-riding populace are able to effectively engage in the feedback process.

3.1.3 Current State-of-the-Practice

Web-based tools are already in use by many transit agencies, primarily through web-based tools such as social media and email. This section highlights some of the best practices among transit agencies today.

Email and Online Forms

Though email is the most used form of online communication (7), and virtually all transit agencies receive email from riders and stakeholders.

Feedback Panels

NJ Transit - Through an ePanel conducted for customer satisfaction among transit commuter rail riders, the agency used geo-location maps to locate the riders' origins and destinations, mapping where their travel took place and pinpointing locations for high and low satisfaction ratings. This allowed NJ Transit to create a map of its riders' routes and satisfaction along those routes to find where improvements could be made (25).

Online Surveys

TriMet – The agency surveyed its Facebook followers and displayed results on its website and Facebook page to let users know that TriMet took their concerns into account (15).

Social Media

Massachusetts Bay Transportation Authority (MBTA) – Massachusetts Bay Transportation Authority (MBTA) – The MBTA asked riders to report broken air conditioning on train cars via Twitter. These tweets allowed fast results as workers were quickly dispatched to fix the problems (16).

Utah Transit Authority (UTA) – The agency used Twitter to host its public meetings discussing the agency's proposal for a fare hike. This allowed staff to answer questions directly regarding the fare hike and take ideas from those participating about other funding possibilities. UTA decided to host the meeting online after a public meeting only garnered an attendance of 12 people. The Twitter discussion was able to attract 50 participants that sent more than 200 tweets (26)

Mobile Applications

OneBusAway – The mobile application allows users of the OneBusAway real-time bus-arrival application in Seattle to provide feedback about problems with the application and transit system in Seattle. After receiving the information, OneBusAway can address reported problems pertaining to the application and forward service-related issues to the transit agency, which resulted in an overall positive growth in transit riding experiences of those in Seattle (27).

3.1.4 Developing Trends in Web-Based Feedback Tools

There are many online tools being used today to facilitate feedback from customers. While most transit agencies tend to use the basic social media tools of Twitter and Facebook, private corporations are starting to use additional tools to broaden the feedback received from their customer base. These

tools can range from internet forums, crowdsourcing applications, online voting contests, and crowdsourced maps.

Several web-based tool developers are also exploring the use of online games to encourage learning, through which users can build operational transit systems, providing players with information on budgets, operation efficiency, and costs and benefits (14). Games, such as Build-a-System by METRO in Portland, Oregon, allow the public to build their own transport system. In return, the game helps players understand the tradeoffs of their transport system decisions, being educated on the costs, benefits and drawbacks to certain in-game decisions and their relation to real world similarities. As more games are implemented, the public can gain a much better understanding and appreciation for their transit systems through increased education and feedback.

There are also tools that allow companies to set up web-based sites where ideas can be shared. Examples of these include IdeaScale, MindMixer, and UserVoice. Companies can create topics for users to discuss, while community members post their own ideas, upload documents or pictures to support them, and comment on other ideas. As ideas are presented to the problem at hand, members can vote on which ones they like the best, allowing companies to pick those ideas that are plausible and implement them. The exact use and facilitation of each tool differs slightly, but overall they have been effective for positive idea generation amongst customers.

Gaps

Two gaps were identified through the literature review that will be addressed here. The first gap identifies the limits of analytical tools to evaluate web-based feedback, which inhibits transit agencies ability to mine useful information from the vast quantities of feedback submitted through their tools. The second area dealt with the lack of effective translation services available for web-based tools, preventing non-English speaking populations from potentially accessing tools offered.

Tools To Evaluate Web-Based Feedback

As of now, it is easy to measure quantitative feedback, such as the number of comments or users each tool is collecting. However, standard processes are missing for measuring the quality and effectiveness of participation (1). For example, users that submit multiple comments may actually be spamming sites, complaining, or giving unpopular opinions. There are tools that can analyze text through sentiment analysis, yet their abilities are still not effective at measuring the quality and the effectiveness of participation (11). In this regard, there need to be tools that can help measure these qualities for users such that agencies can better understand who their effective users are, what portion of their feedback is useful, and how they can tweak their feedback methods to gain better information from riders.

Translation Services

Translation tools can help people of all backgrounds communicate on a single website without requiring multiple websites or built-in translators. On web-based tools other than social media, translation is often unavailable, which disqualifies portions of the population that don't understand English from participating. Though third-party applications that translate sites exist, their accuracy and ability to adapt to all web-based tools is still less than desired.

The benefits, drawbacks, and 'best practices' in use today help exemplify the current state of the practice for web-based feedback tools. However, there are still gaps in understanding how transit agencies collect, manage, and respond to online feedback. Additionally, it is still not fully understood how transit agencies interact with their riders through the web. Therefore, the following chapter will explain the methodology used for this study, and help present findings as to how web-based tools can help bridge the gap between transit agencies and their riders.

Chapter 4 Methodology

An online survey of transit agencies was conducted to understand which agencies are using web-based tools for customer feedback, how those tools are used, and the results that agencies have seen from their use.

The survey invitation was distributed via email to transit agencies on the American Public Transit Associations (APTA) Marketing and Communications Committee list. The research team supplemented the APTA list with several small and medium-size agencies identified through the National Transit Database (NTD) to obtain better representation from small and rural operators. These agencies were all tracked for response, and email and phone follow-ups were pursued to obtain a high response rate. In addition, participation was solicited via email news blasts, popular transit blogs, social media, and emails to transportation organizations in the US and abroad. Transit organizations were asked to respond to the survey regardless of whether they had an online web-based feedback tool or not. The questionnaire is provided in Appendix A.

The author ultimately sent email invitations to 144 transportation providers in the United States and Canada to participate in this online survey. Surveys were received from 117 of the transit operators solicited, a response rate of 81%. An additional 13 agencies responded based on the blog posts, social media outreach, and emails sent on behalf of the research team to listservs. All 130 responding agencies were included in the survey analysis. Respondents represented transit agencies from 38 U.S. states, the District of Columbia, and one Canadian province.

4.1 Agency Overview

The agencies responding to the survey were categorized two ways: by annual unlinked trips and by the size of urbanized or metropolitan area in which they are located (UZA). First, agencies were

classified as large, medium, or small based on their total number of unlinked trips for the most recent year as reported in the NTD. This classification resulted in 37 large agencies (29%) which carry more than 20 million annual unlinked trips, 50 medium agencies (38%) which carry between 2 and 20 million annual unlinked trips, and 43 small agencies (33%) which carry fewer than 2 million annual unlinked trips (see Table 1). A map of transit agencies based on size of unlinked trips is provided in Figure 1.

Second, agencies were classified by the size of the urbanized area they served, regardless of annual unlinked trips. Large metropolitan areas often have multiple transit providers, characterized by one or more large regional transit agencies that are supplemented by smaller agencies that target local markets. Although these small agencies are separate entities from the larger agencies serving the same urbanized area, they may coordinate with their regional partners for customer information and may use the same tools for interacting with customers. To see if there were differences in use of web-based feedback based on size of the urbanized area (e.g., are city residents more likely to use technology than their rural counterparts?), the analysis included a comparison of responses by UZA size. Of the 130 collected surveys, 76 agencies (59%) were located in large UZAs, defined as urbanized areas with a population of 500,000 or more, 14 agencies (11%) were in medium UZAs (population 200,000 - 500,000) and 40 (30%) agencies were in small UZAs (population less than 200,000) (See Table 2). A map of transit agencies based on size of UZA is provided in Figure 2. Listings of agencies by size of agency and by UZA category are provided in Appendix B.

Survey results cover agencies that operate all modes of transit service. Almost all of the agencies responding to the survey (97%) operate fixed bus service. Heavy rail service is operated by 14% of the respondents, commuter rail service is operated by 8% of the agencies, and 7% of the agencies responding operate light rail service. Trolleys and ferries are operated by three agencies, with cable cars and automated guideway systems operated by one agency each.

Table 1 Definitions of Large, Medium and Small Agencies based on Annual Unlinked Trips

	Total Unlinked Trips	Example City	Total
Large Agency	>20,000,000	Portland, Oregon – TriMet	37
Medium	2,000,000<x<20,000,000	Columbia, Missouri – Columbia Transit	50
Small Agency	<2,000,000	Grand Rapids, North Dakota –Cities Area	43

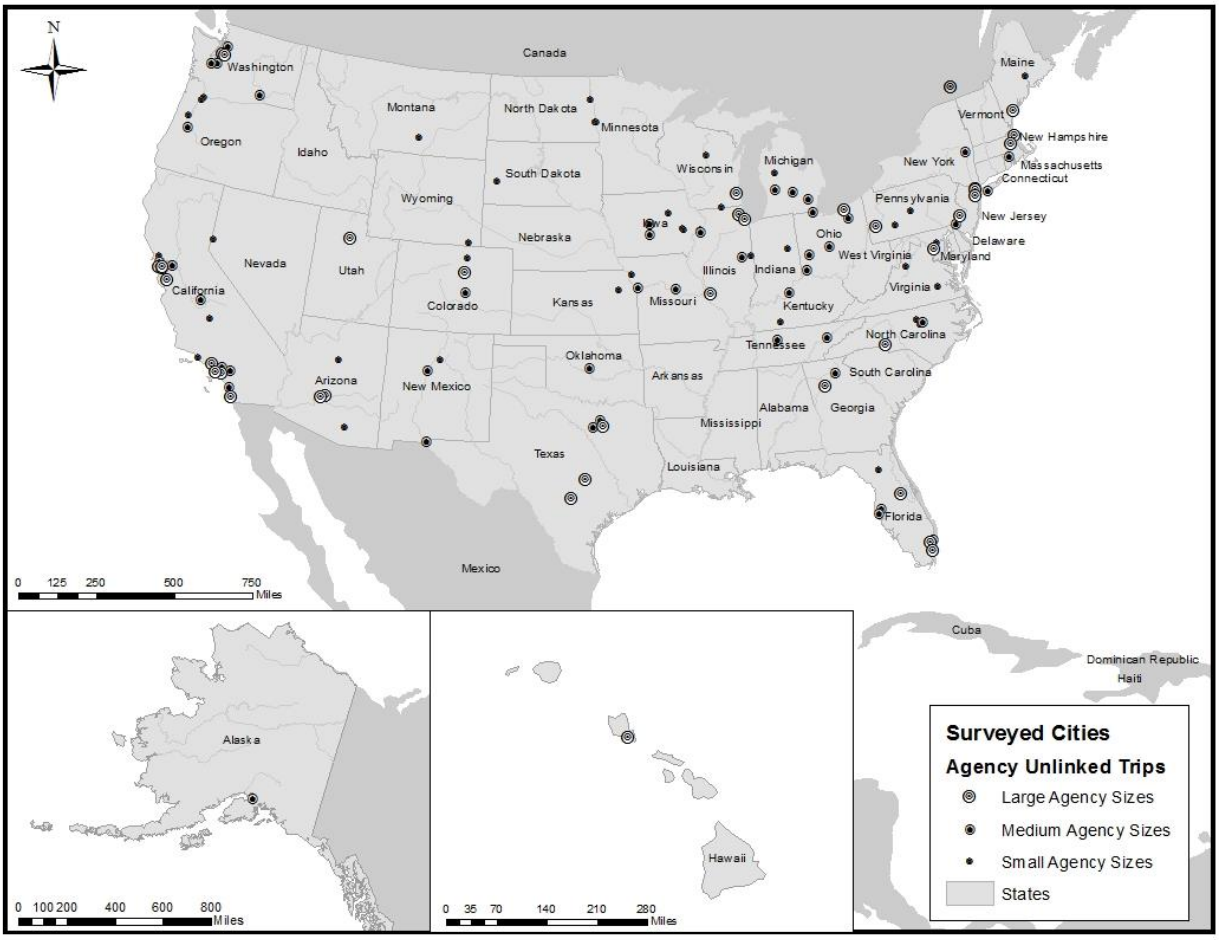


Figure 1 Locations of Survey Respondents by Agency Size, Based on Annual Unlinked Trips

Table 2 Definitions of Large, Medium and Small Urbanized Areas[1]

	Population	Example City	Total Respondents
Large Urbanized Area	>500,000	San Francisco, California –	76
Medium Urbanized	200,000<x<500,000	Ann Arbor, Michigan – Ann	14
Small Urbanized Area	<200,000	Corvallis, Oregon – City of	40

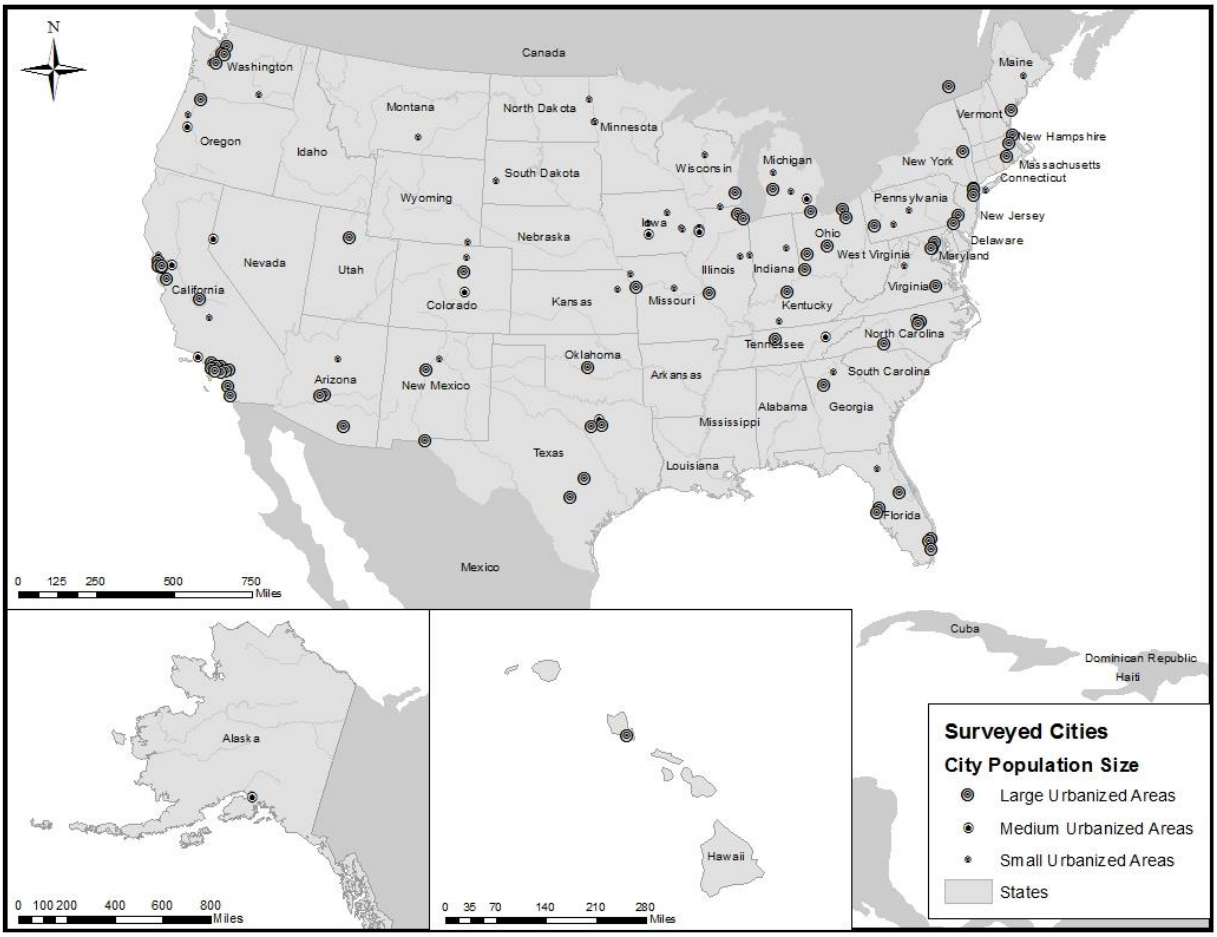


Figure 2 Locations of Survey Respondents by Size of Urbanized Area

[1] The definitions are adapted from the National Transit Database by the Federal Transit Administration (http://www.ntdprogram.gov/ntdprogram/pubs/ARM/2012/pdf/2012_Basic_Information_Module.pdf)

4.1.1 Consistency Checking for Survey Results

Consistency checking was performed twice throughout the analysis, using similar minded responses to ensure that agencies were responding in a consistent manner. To test this, agencies responding to the drawback *"Most riders don't have Internet/smartphones"* were checked against their additional response in Figure 19 "*What is the estimate of the percentage of your riders that have Internet access/smartphones?*". The consistency check addressed each agencies' estimate for rider access to Internet and smartphones, with the results available in Table 3 and Table 4.

Table 3 Consistency Checking Drawbacks against Rider's Estimated Access to the Internet

"What are the drawbacks to your agency with the existing web-based feedback tools?"		
# of Small Agencies Answering this Question	# of Small Agencies Replying "Most Riders Don't Have Internet/Smartphones"	# of Small Agencies **Not** Replying "Most Riders Don't Have Internet/Smartphones"
32	12 (38%)	20 (62%)
Agencies Stating <60% of Riders have Access to Internet	9 (28%)	4 (13%)
Agencies Stating >60% of Riders have Access to Internet	2 (6%)	12 (38%)
Agencies Stating they Don't Know rider access to Internet	1 (3%)	4 (13%)

Table 4 Consistency Checking Drawbacks against Rider's Estimated Access to Smartphones

"What are the drawbacks to your agency with the existing web-based feedback tools?"		
# of Small Agencies Answering this Question	# of Small Agencies Replying "Most Riders Don't Have Internet/Smartphones"	# of Small Agencies **Not** Replying "Most Riders Don't Have Internet/Smartphones"
32	12 (38%)	20 (62%)
Agencies Stating <60% of Riders have Access to Smartphones	10 (32%)	10 (32%)
Agencies Stating >60% of Riders have Access to Smartphones	0 (0%)	4 (13%)
Agencies Stating they Don't Know rider access to Smartphones	2 (6%)	6 (19%)

Out of the 43 small agencies surveyed, 32 responded to the question regarding drawbacks related to web-based feedback tools. 38% of these agencies stated that *"Most riders don't have Internet/smartphones"*, while the remaining 62% implied that most of their riders did have

Internet/smartphones. For Internet access, 28% who stated their riders didn't have access to Internet also reported that less than 60% of their riders had Internet Access, while 68% who stated their riders did have access to Internet reported that more than 60% of their riders had Internet Access. However, smartphone access did not show as much consistency. 32% of the agencies who stated their riders didn't have access to smartphones, and 32% of the agencies who stated their riders did have access to smartphones both reported that less than 60% of the riders had access to smartphones.

Because of the differences noticed here between agency responses to Internet and smartphones, another test was conducted utilizing the drawback *"Most riders don't have Internet/smartphones"*. Using a factorial regression analysis with dependent variable *"Most riders don't have Internet/smartphones"*, several other survey responses were tested to see what prompted transit agencies to report this finding. From the test, both estimates for rider access to Internet and rider access to smartphones were found to be statistically significant, indicating that agencies reporting higher rider accessibility to both technologies were negatively associated for reporting this drawback. At the same time, small agencies were found to be statistically significant as well, indicating that they were positively association for selecting this variable as a drawback to using web-based feedback tools (all statistical tests from this report can be found in Appendix D). These consistency measures indicate that there are slight differences between agency responses, which will be addressed in the discussion.

Chapter 5 Survey Results

5.1 Survey Findings

The survey conducted for this synthesis study first asked respondents which web-based feedback tools they use, with multiple answers being acceptable. The tools were defined as follows:

- E-mail – Customers send e-mail to the agency directly or via link on website. This does not include email blasts or other email communications that originate with the agency.
- Online Surveys – An agency posts a questionnaire or a survey on its website or other online location for users to complete. Topics may include customer satisfaction, service alternatives, or other agency questions.
- Online Forms – Users can submit questions and comments to an agency typically through a webpage. Forms may be open-ended or include drop-down menus or other options for users to structure their feedback.
- Online Feedback Panels – Agencies sponsor groups that are asked to comment about specific topics or respond to surveys. Groups are typically invitation-only and interact with the agency through a website or other online interface.
- Social Media – Users communicate with agency through social media channels, such as the agency's Facebook page, Twitter account, or official blog.
- Crowdsourcing – Agencies host online conversations where users can submit suggestions, offer comments, and vote on their favorite idea. Agencies typically use third-party platforms such as SeeClickFix, IdeaScale, MindMixer, etc.
- Internet Forums – Users participate in online discussion sites where they can hold conversations in the form of posted messages, e.g. NYCtransitforums.com, transittalk.proboards.com. These are also known as online communities, bulletin boards or message boards.

- Mobile Feedback – Users submit feedback or information to an agency using as application on a smartphone. Examples include mobile applications like See & Say where customers can alert agencies to safety and security issues.

Among the 130 agencies answering this question, email was the most prevalent web-based feedback tool. Email is used by 92% of the agencies that responded. Of the 11 agencies that stated they do not use email, six use other web-based feedback, such as online forms. The remaining five agencies stated they do not use any form of web-based feedback. Social media, online surveys, and online forms were the next most prevalent with 77%, 68%, and 65% respectively. The remaining categories (online feedback panels, crowdsourcing, Internet forums, and mobile feedback) all saw less than 15% usage by transit agencies for collecting web-based feedback (see Figure 3).

The frequent response of agencies using email and social media are not unexpected; these tools have been around for a number of years and have been adopted by the general population.

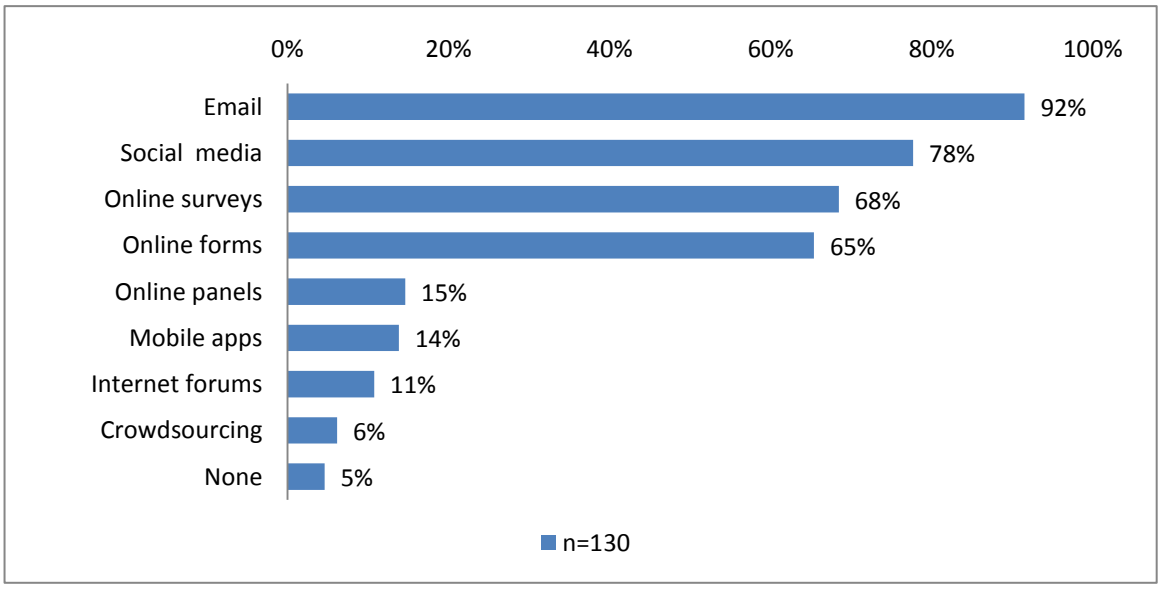


Figure 3 "Which of the following web-based customer feedback tools does your agency currently employ?"

Usage of web-based feedback tools was analyzed by size of agency and size of UZA in which the agency is located (see Table 5 and Table 6, as well as Figure 4 and Figure 5).

Large and medium agencies use web-based tools more frequently than small agencies. All respondents from large and medium agencies indicated that they use at least one form of web-based tools. On the contrary, 12% of the respondents from small agencies indicated that they do not employ any form of web-based tools. When broken out by web-based tool types, a much larger share of large and medium agencies responded that they use social media, online surveys, and online forms, compared to their smaller counterparts. A higher percentage of large agency respondents indicated they use mobile feedback and crowdsourcing than medium and small agency respondents. When compared by size of UZA, the trends in the responses are similar with subtle differences. As the first question asked of this research related to analyzing how agency size affected the use of web-based feedback tools, a chi-square test was conducted regarding differences in the number of tools each agency uses and its size. It was found that the number of tools used by each agency had a statistically significant relationship with agency size (X^2=57.264, p = .000). That is to say, the larger the transit agency, the more web-based feedback tools they are likely to use to connect with riders.

Table 5 Percentage of Agencies Using Different Web-based Tools by Size of Agency

	Respondents	E-mail	Social Media	Online Surveys	Online Forms	Online Panels	Mobile Feedback	Internet Forums	Crowd-sourcing	None
Large Agency	37	89%	86%	84%	86%	27%	35%	14%	14%	0%
Medium Agency	50	98%	88%	82%	74%	14%	6%	8%	4%	0%
Small Agency	43	86%	58%	40%	37%	5%	5%	12%	2%	12%

Table 6 Percentage of Agencies Using Different Web-based Tools by Size of UZA

	Respondents	E-mail	Social Media	Online Surveys	Online Forms	Online Panels	Mobile Feedback	Internet Forums	Crowd-sourcing	None
Large UZA	76	92%	82%	82%	84%	21%	18%	8%	7%	1%
Medium UZA	14	92%	78%	57%	50%	0%	14%	7%	7%	7%
Small UZA	40	90%	68%	48%	35%	8%	5%	15%	5%	7%

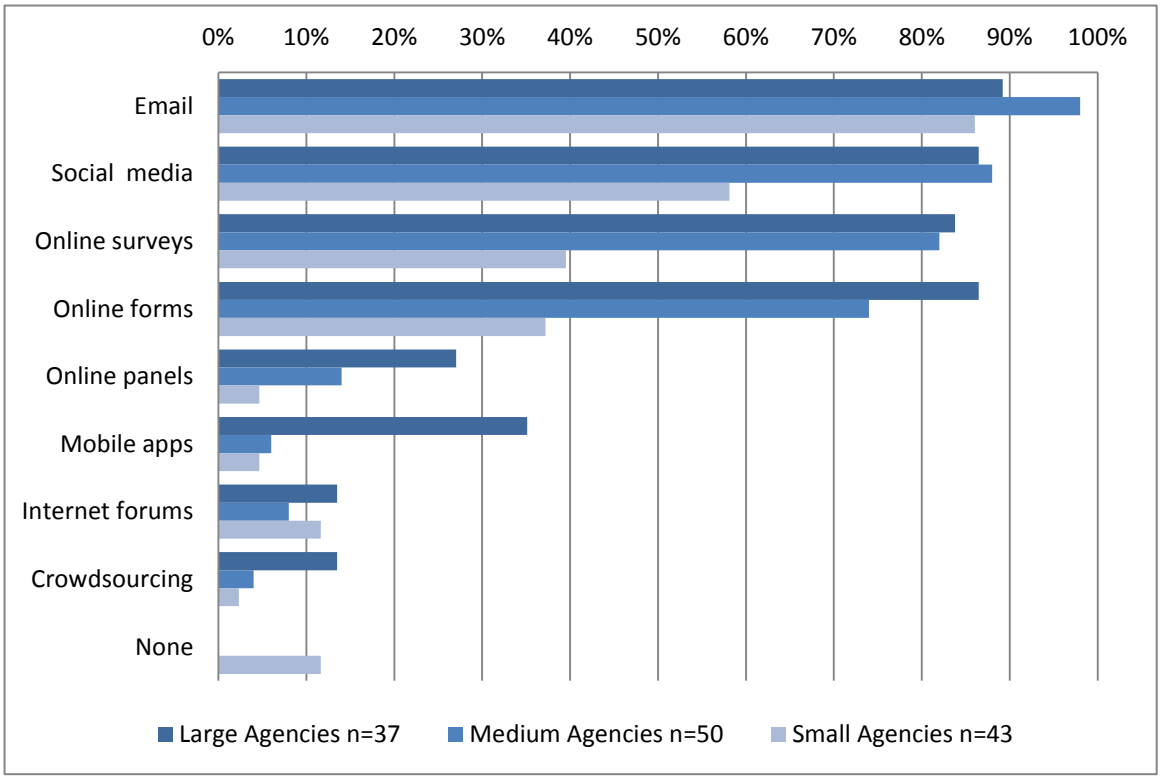


Figure 4 Web-based Tools Used by Agencies by Size of Agency

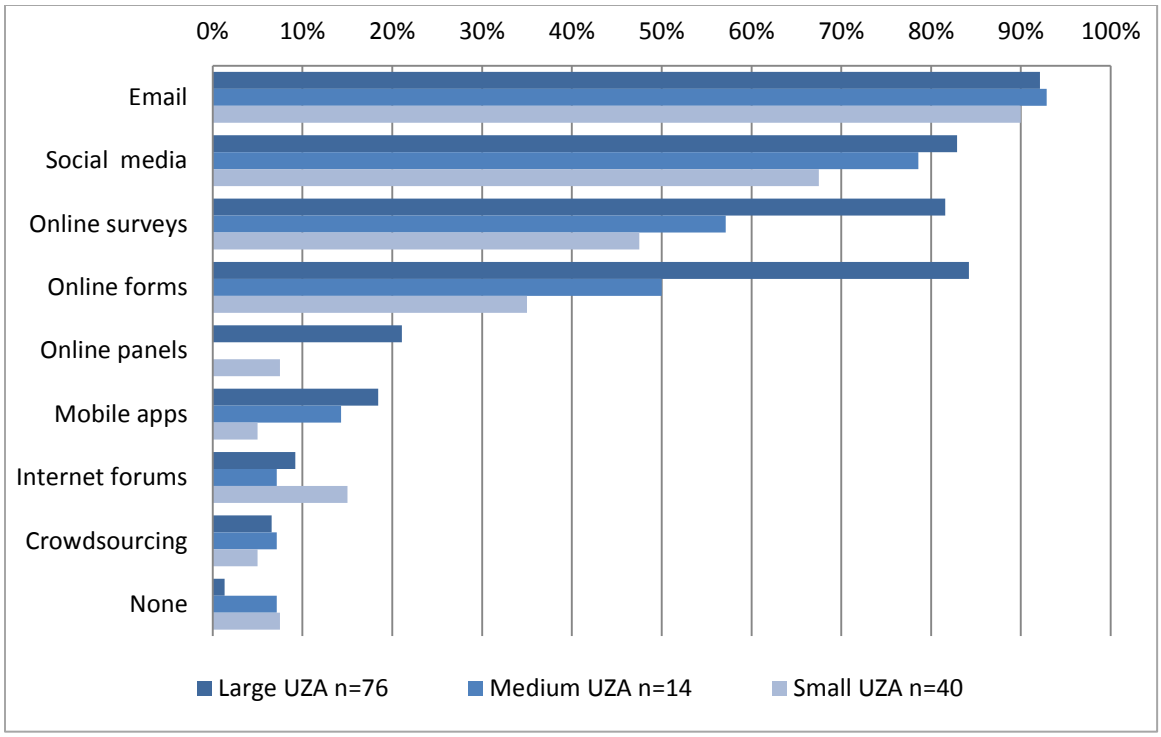


Figure 5 Web-based Tools Used by Agencies by Size of Urbanized Area

5.1.1 Solicited Versus Unsolicited Feedback

Survey respondents were provided the following definitions of solicited and unsolicited feedback as background to the next set of questions:

> This survey is looking at two types of web-based feedback that an agency may receive: unsolicited and solicited. *Unsolicited* feedback does not respond to specific agency questions and includes all the comments, suggestions, complaints, and opinions that flow into the agency on a daily basis. *Solicited* feedback is structured by the agency that asks riders and the public to provide comment on specific topics of interest to the agency, such as service of fare changes, service quality or customer satisfaction.

Survey respondents were asked what categories of unsolicited feedback their agency currently receives from its rider base. Of the 117 responses provided, 100% received unsolicited feedback in the form of "complaints and commendations," with another 97% receiving unsolicited feedback regarding their "transit service operations". "Long range and capital planning" saw the least amount of unsolicited feedback, with only 44% of respondents reporting unsolicited feedback in this area.

Respondents were then asked to identify what categories of feedback their agency actively solicits from its rider base. "Service planning" was the most common category with 84% of respondents reporting that they solicit service planning feedback from their riders; another 75% reported soliciting "transit service operations" feedback from their riders. "Budgeting and fares" was identified by 62% of the agencies as a category for soliciting customer feedback, and 59% of the responding agencies actively solicited "complaints and commendations". Only 7% responded that they didn't solicit any information from their riders (see Figure 6).

It is interesting to note that the third and fourth most common categories for unsolicited feedback, "safety and security" and "maintenance" issues, are the least common categories for soliciting feedback.

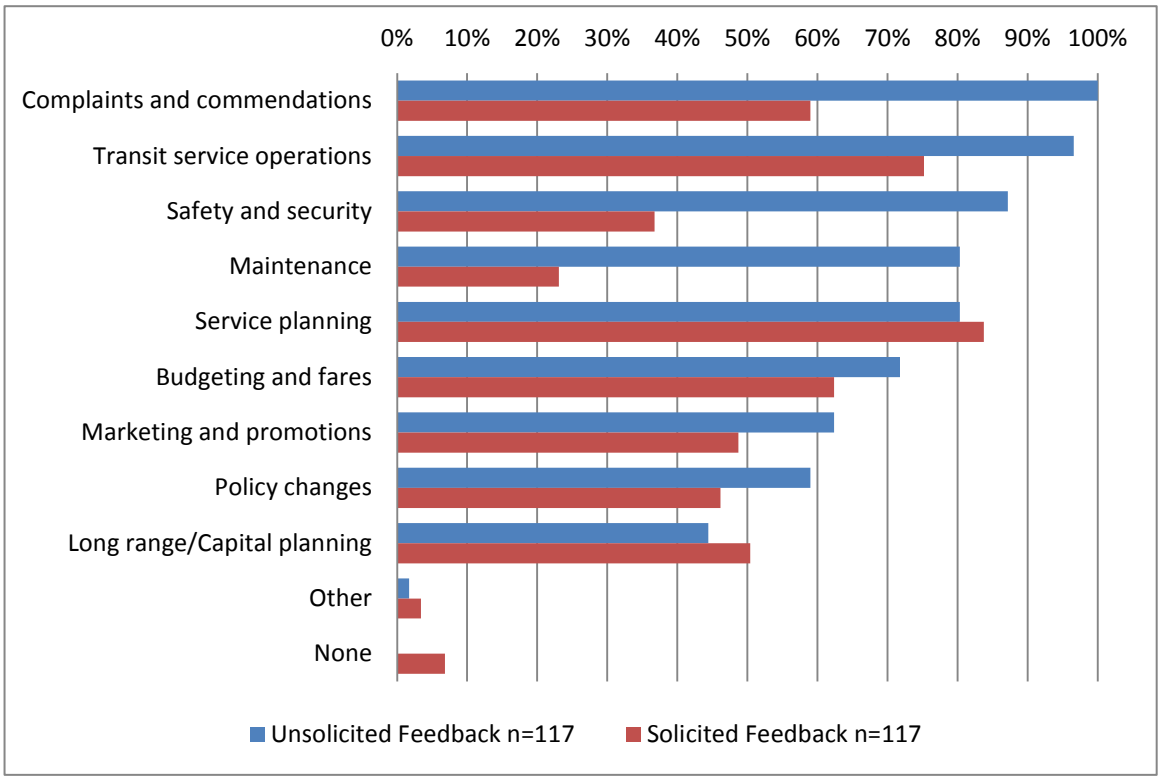


Figure 6 "What categories of unsolicited and solicited feedback does your agency currently receive from its rider base?"

Transit agencies were asked to identify which web-based tools they use to solicit customer feedback, by category of feedback. Regardless of what information is solicited, the majority of respondents use email, online surveys, online forms, and social media as primary tools (see Figure 7). The remaining web-based tools were generally used by less than 10% of the agencies to solicit information from the public. The usage trends broken down by feedback categories are similar across the nine categories, and closely mirror the overall usage trend as depicted in Figure 3. Two areas that stuck out found that social media was most commonly used for Marketing, and Complaints and Commendations were obtained more often via online forms than the other comment categories.

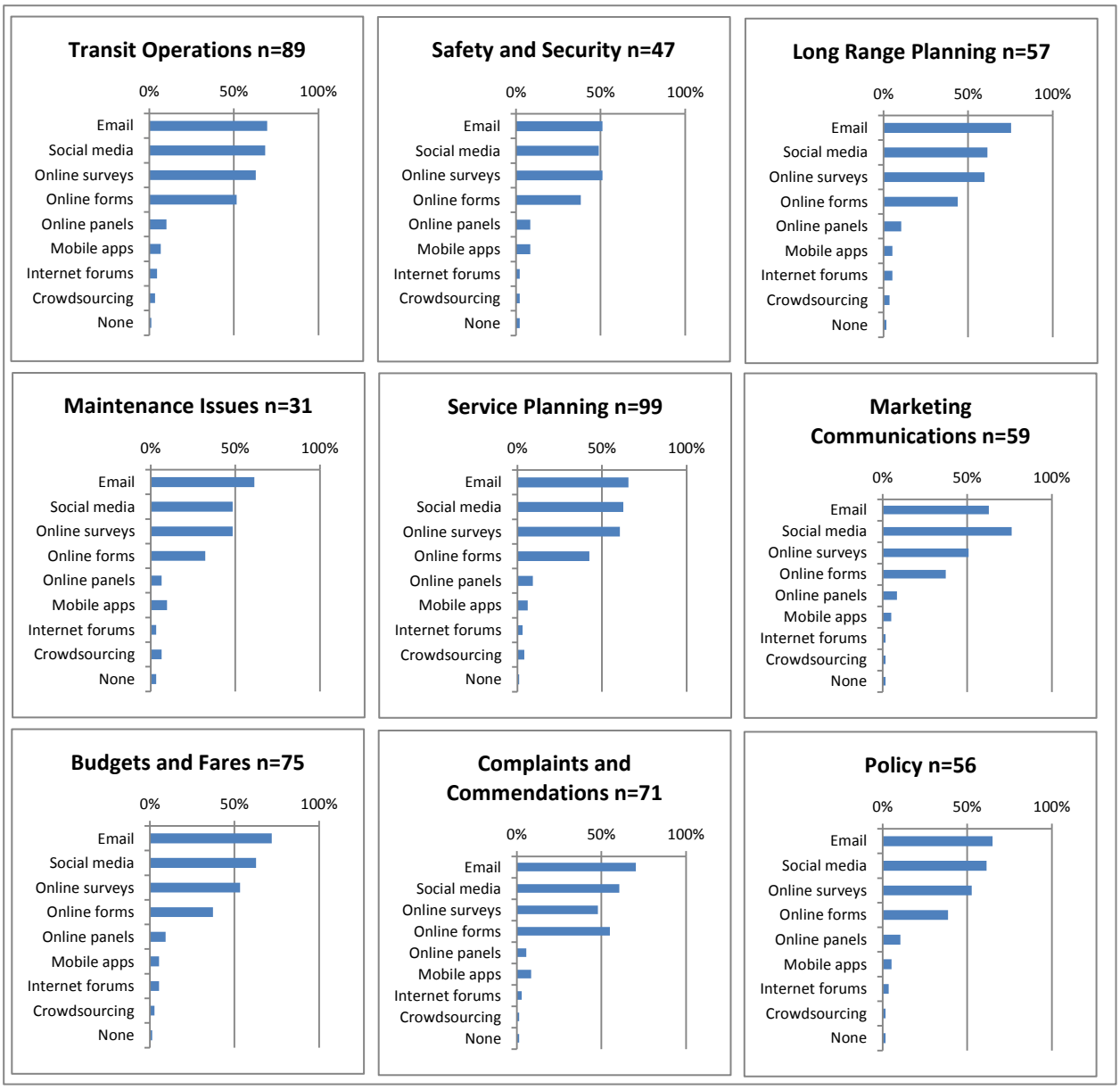


Figure 7 "What web-based tools do you use to solicit customer feedback, by topic area?"

5.2 Administration of Web-based Customer Feedback

5.2.1 Handling Customer Feedback

Agencies were asked "*What department in your agency has primary responsibility for initiating, implementing, and monitoring web-based customer feedback tools?*" For 45% of the agencies, responsibilities are *"…allocated to the relevant departments, (Public Relations initiates, IT implements technology, customer service monitors, etc.)*" while 31% of the agencies responded that a "*specific department was responsible for web-based customer feedback*" (see Figure 8). Only 15% of the agencies responded that "*each department develops and implements their own web-based feedback tools*." Most agencies who responded "other" listed a specific department, typically marketing or communications.

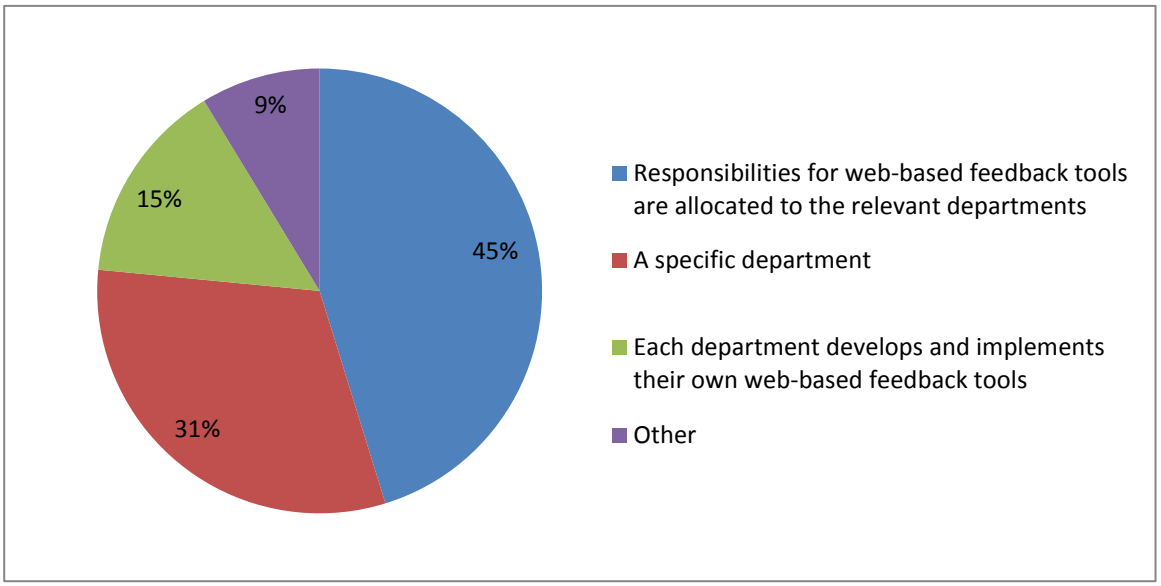


Figure 8 "What department in your agency has primary responsibility for initiating, implementing, and monitoring web-based customer feedback tools?"

When asked "*how is information from web-based customer feedback incorporated into agency operations and planning*," agencies were evenly divided: 30% selected "*Specific staff from throughout the agency are assigned to each web-based tool and respond or forward comments, as appropriate;*" 26% of the responding agencies reported that comments are directed to the customer service

department and treated the same as any other feedback; and 25% of the agencies assigned the department that created the tool to handle the customer web-based feedback. Only 6% of the responding agencies created a "*special department specifically to develop, monitor, address, and handle feedback*" (see Figure 9). There are differences in the way that information is incorporated into the feedback system based on the size of the agency. For large agencies, no single method stands out for incorporating feedback. Medium agencies are more likely to route comments to the customer service department and treat them the same as any other feedback.

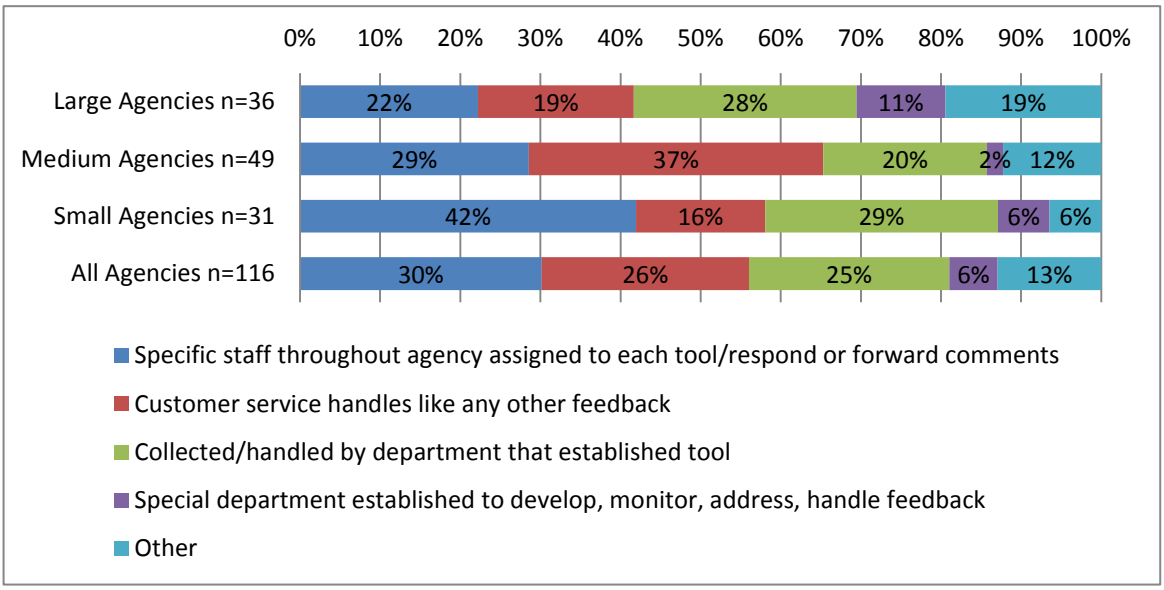


Figure 9 "How is information from web-based customer feedback incorporated into agency operations and planning?"

5.3 Tracking and Reporting Feedback

Transit agencies were asked to select which option "*best describes the level of tracking and reporting of web-based customer feedback tools at their agency*." Almost two-thirds (64%) of the agencies reported that they integrate their web-based feedback with existing customer feedback reporting systems. A separate tracking and reporting system for web-based customer feedback was cited by 11% of the agencies. Twenty-one percent of the agencies reported that they do not

systematically track and report information from the web-based customer feedback tools (see Figure 10).

When looking at how feedback is tracked and reported by size of agency, large agencies are most likely to "*integrate web-based feedback into existing customer feedback reporting systems*" (72%) with only 8% responding that they "*do not systematically track and report information from our web-based customer feedback tools*." Medium size agencies are somewhat less likely to integrate web-based feedback into existing systems (65%) and more likely not to have any systematic tracking and reporting of web-based feedback (21%). Over a third (35%) of the small agencies reported that they do not systematically track and report web-based customer feedback. It is not known if these agencies have a system for tracking non-web-based customer feedback (see Figure 10).

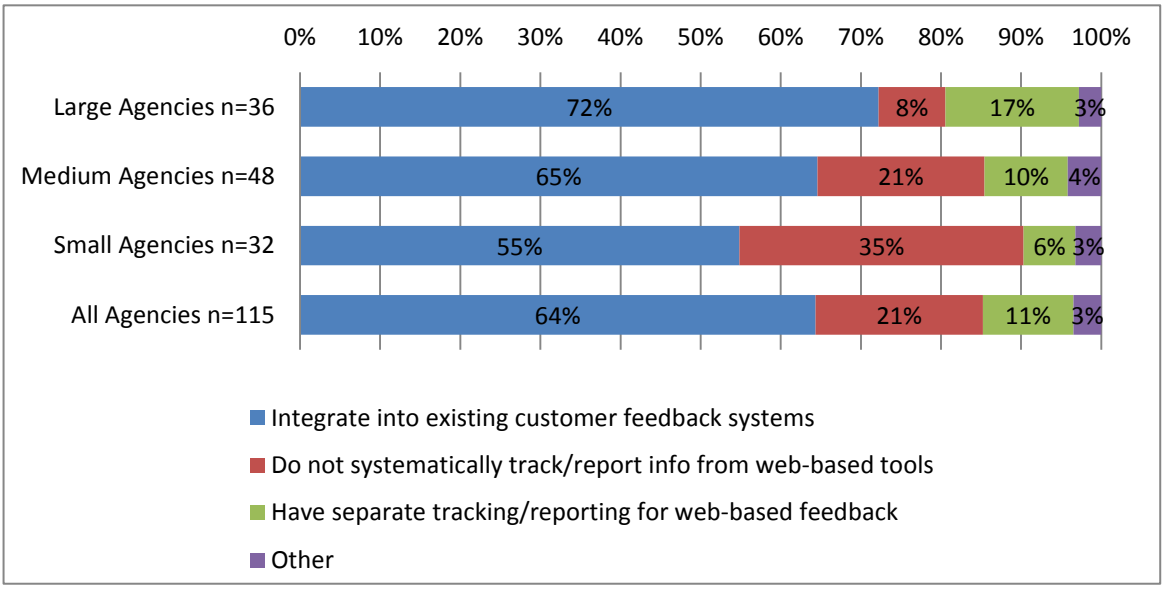


Figure 10 "Which best describes the level of tracking and reporting of web-based customer feedback tools at your agency?"

5.3.1 Measuring Performance

Survey respondents were asked which option best describes their agency's performance measurement activities to improve transit services. Most agencies (70%) responded that they "*regularly monitor and report a broad range of agency performance measures, including customer feedback measures.*" Another 15% of agencies stated that they "*periodically measure performance, but do not have a regular performance measurement reporting program*," and 11% "*regularly report and monitor agency performance measures, but do not have customer feedback measures*" (see Figure 11).

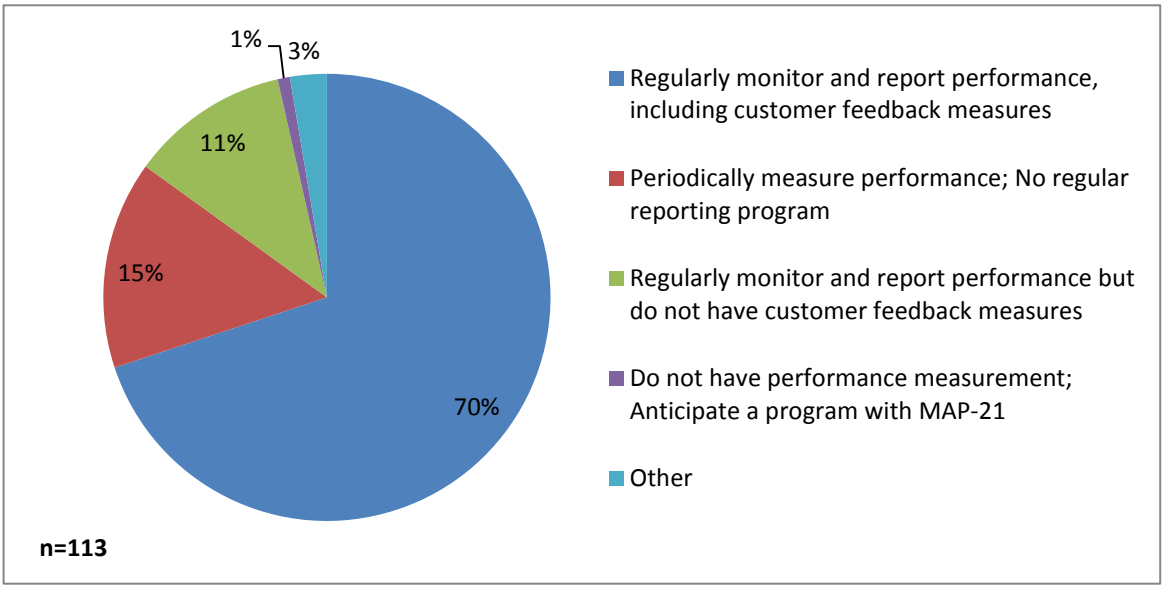


Figure 11 "Which best describes your agency's performance measurement activities to improve transit service?"

5.4 Benefits and Drawbacks of Web-based Feedback

5.4.1 Benefits of Using Web-based Feedback Tools

When asked "*What are the benefits to your agency for using web-based feedback tools*," most of the respondents (91%) cited the increased opportunity for all customers to provide positive feedback. This was followed by "*Enhances agency image (innovative, customer-oriented, engaged with riders)*" and "*Cost effectively collects customer feedback (less data entry, easy data retrieval),*" with 83% and 81%

respectively (see Figure 12). Over three-quarters (76%) of the transit agencies saw the ability to interact with customers in real time as a benefit.

Only one response category, "*Improves the ability of special populations to provide feedback,*" was selected by less than half of the agencies (46%). Breaking down the responses by agency size, it became apparent that most agencies, regardless of their size, find the same benefits from using web-based feedback (see Figure 13).

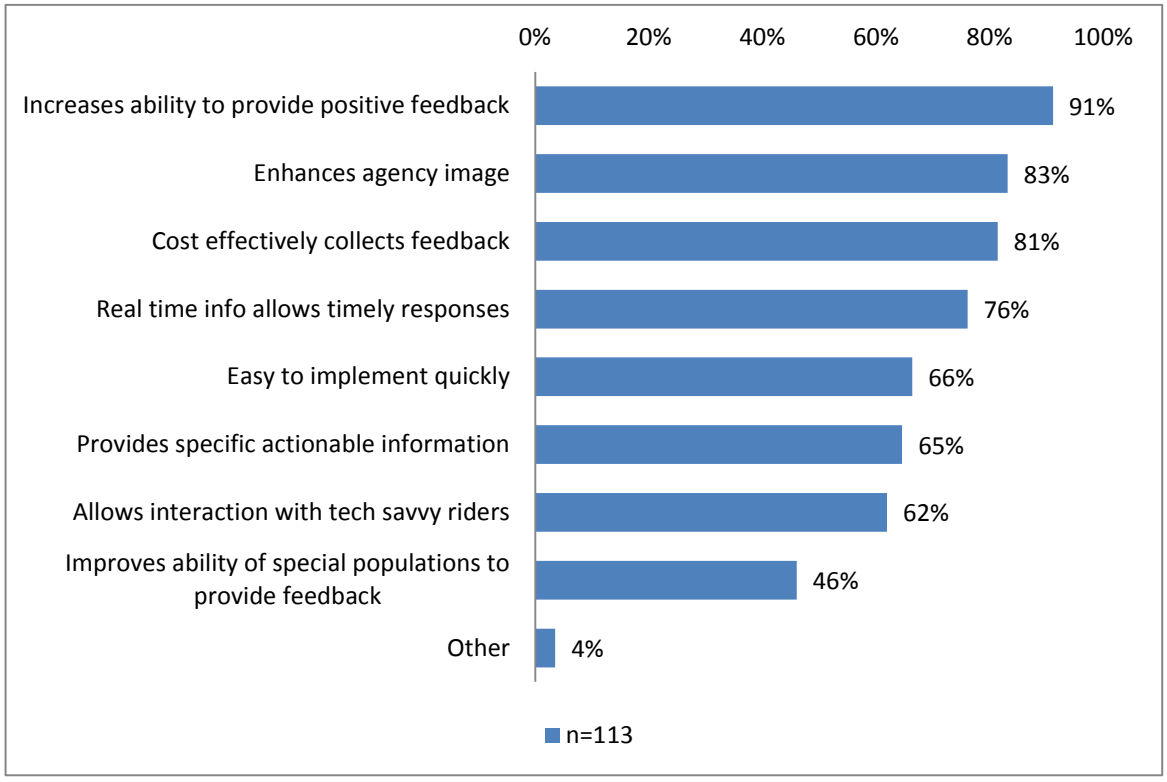


Figure 12 "What are the benefits to your agency for using web-based feedback tools?"

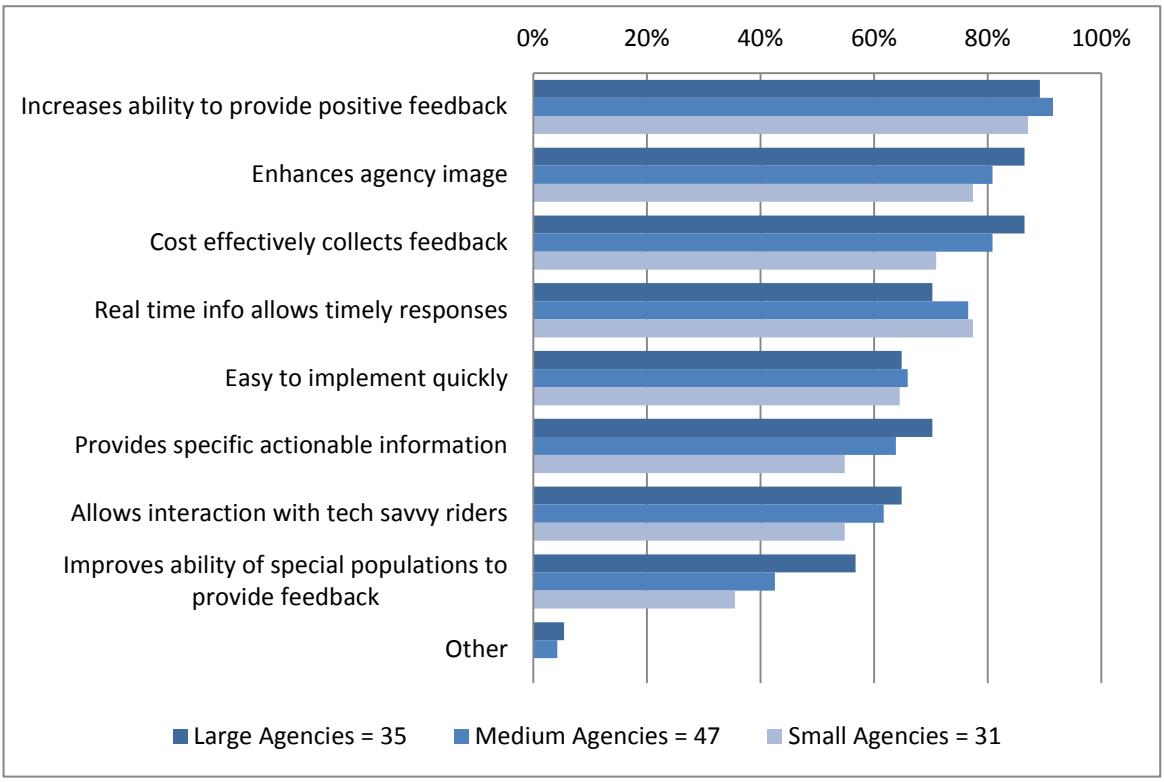


Figure 13 Benefits of Web-based Feedback by Size of Agency

5.4.2 Drawbacks of using Web-based Feedback Tools

Respondents were asked to select the "*drawbacks to their agency with the existing web-based feedback tools*." Lack of staff to respond to comments in a timely manner (64% of respondents) was the largest drawback and the only one that was selected by more than half of the agencies. "*Potential negative feedback could affect agency image*" and "*Difficult to comply with archiving, record keeping and other regulations*" (38% and 34% of respondents, respectively) were the next most commonly selected drawbacks (see Figure 14). Respondents did not appear to consider the other identified drawbacks as serious concerns; no more than 20% of respondents selected any other reasons. Responses in the "other" category (selected by 11% of respondents) were primarily related to customers who do not use the Internet (even though they may have access) and concerns that web-based feedback tools do not reach all populations.

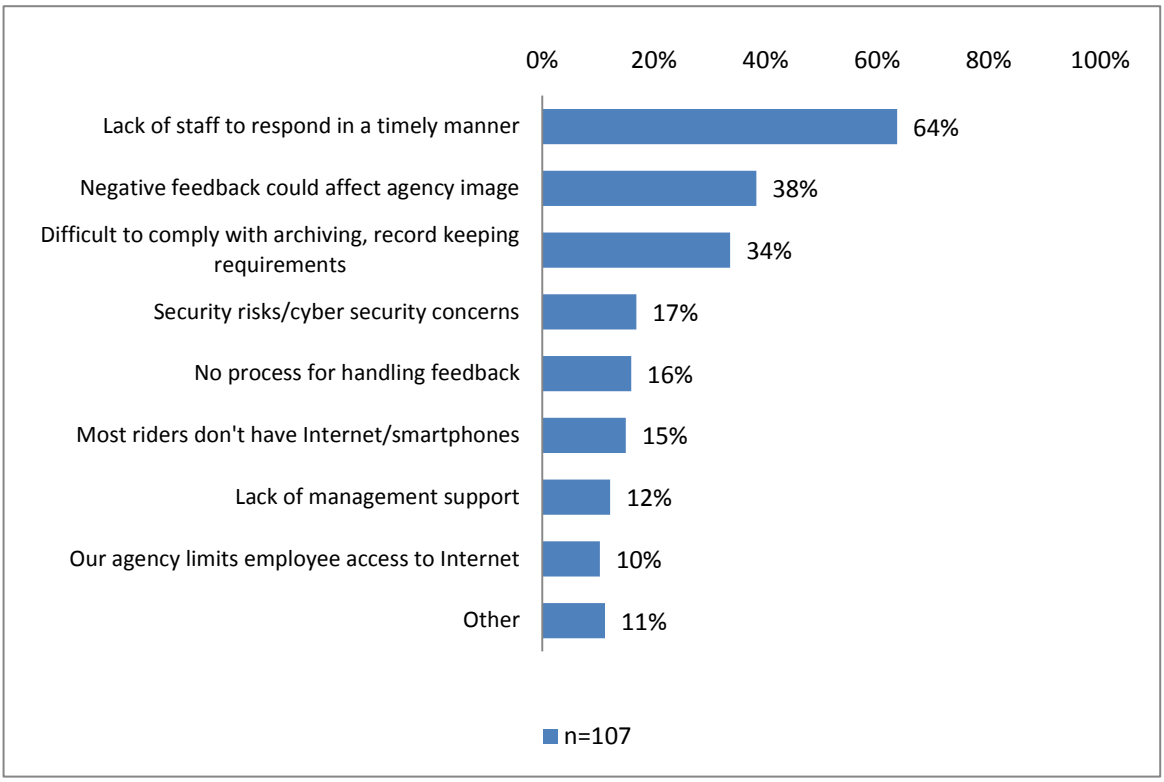


Figure 14 "What are the drawbacks to your agency with the existing web-based feedback tools?"

Agency responses about drawbacks of the existing web-based feedback tools did not show much variation by size of agency. The only major differences were that smaller agencies were less likely to agree that the potential for negative feedback could impact the agency's image, and they were also more likely to agree that their riders did not use the Internet or have smartphones. Otherwise, most of the perceived drawbacks with web-based feedback tools were common to agencies of all sizes (see Figure 15).

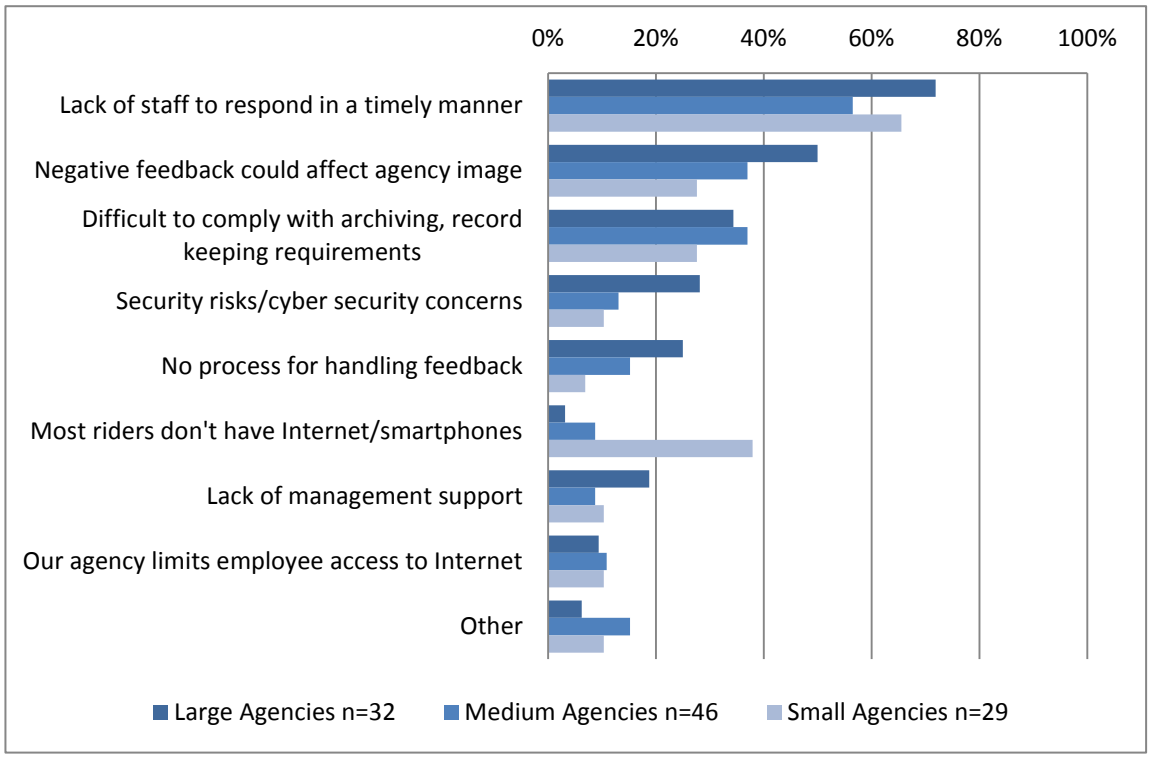


Figure 15 Drawbacks Affecting Agencies by Size of Agency

Noticing that "*Most of our riders don't have Internet/smartphones*" was a far larger response for small agencies than both medium and large agencies, a chi-square test was conducted to see if it was statistically significant. From the test it was found that the response was negatively associated with agency size (X^2=16.235, p = .000). Regarding the first question being analyzed by this thesis, it was once again found that agency size is having an effect on agencies abilities to utilize web-based tools.

5.4.3 Barriers to Adding Web-based Feedback Tools

Agencies were asked "*What is preventing your agency from adding web-based feedback tools?*" Over half of the respondents noted that the "*lack of staff resources to develop, implement, and maintain the tool*" is an obstacle (57% of respondents). At the same time, 34% of agencies responded, "*Does not apply – nothing is preventing us*" from expanding their web-based tools (see Figure 16).

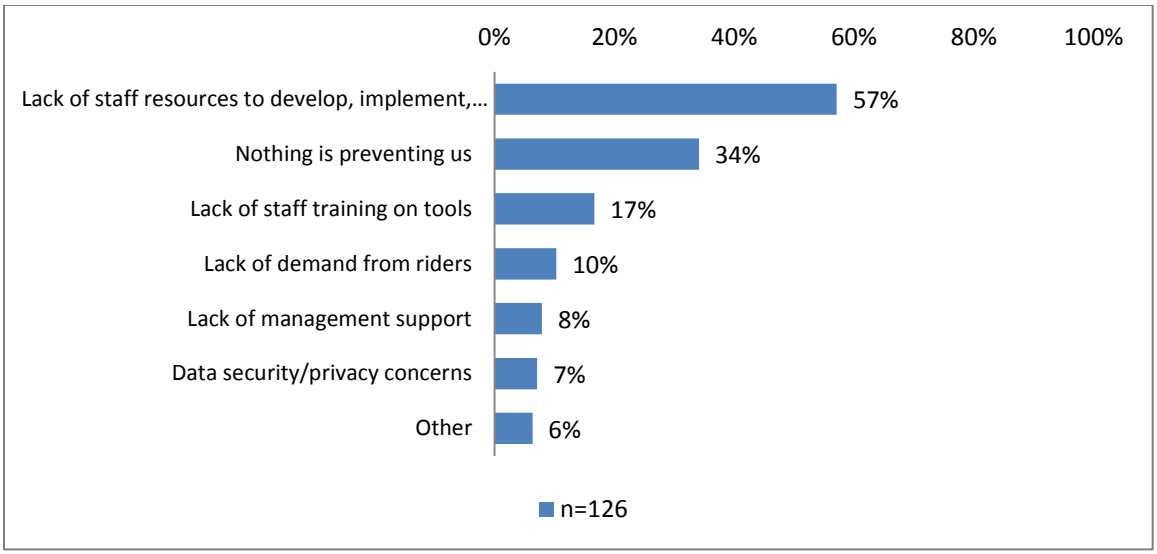


Figure 16 "What is preventing your agency from adding web-based feedback tools?"

5.5 Staff Resources Used to Support Web-based Tools

To understand current resources allocated to supporting web-based feedback tools, agencies were asked "*What is the approximate level of staff resources (across all departments) used to support web-based customer feedback activities."* The majority of answers (60%) were 5 full time employees (FTE) or fewer, although there were some agencies that stated they have more than 50 FTE supporting web-based feedback tools. The higher figures may represent staff resources to support the full range of customer feedback activities, given that many agencies integrate web-based feedback with other feedback systems. One out of four agencies did not provide an estimate of staff resources used to support web-based feedback.

5.6 Future Use of Web-based Feedback Tools

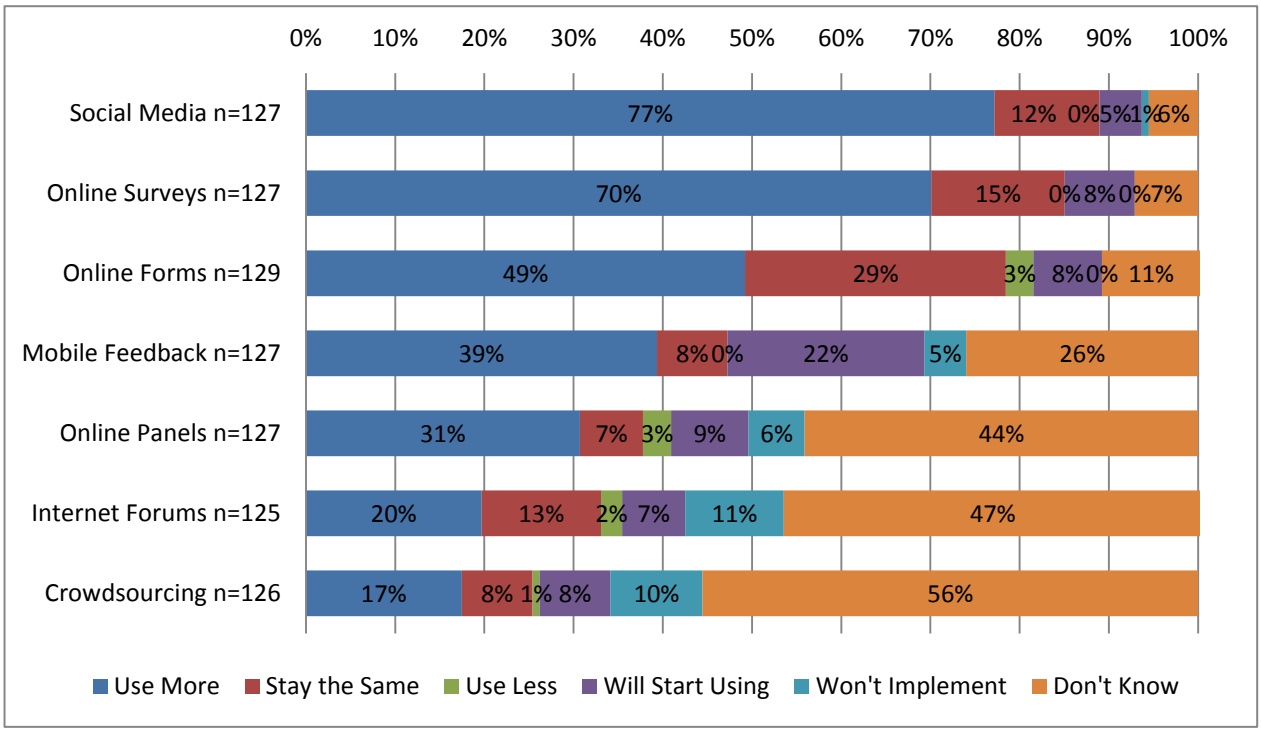
When asked "*How do you anticipate your use of the following web-based tools will change over the next five years,*" two tools stood out as likely to be used more: social media and online surveys with 77% and 70% of respondents, respectively (see Table 7 and Figure 17). Both of these were among the

tools that most agencies are currently using, as shown in Figure 3. Adding the agencies who "*will start using*" together with those that "*will use more*," 82% of the agencies anticipate using social media within the next five years as a tool to gather feedback and 78% anticipate using online surveys. Mobile applications is the tool that could see the most growth, with 22% of respondents anticipating that they would "*start using*" this type of web-based customer feedback tool over the next five years.

It is worth noting that almost no agencies stated they would "*stop using*" or use tools less over the next five years. Agencies are keeping their options open, with very few agencies stating that they "*would not implement*" a specific feedback tool and a sizable percentage saying they "*don't know*."

Table 7 Agencies Anticipated Change in Use of Web-based Feedback Tools

	Use More	Stay the Same	Use Less	Stop Using	Will Start Using	Won't Implement	Don't Know
Social Media	77%	12%	0%	0%	5%	1%	6%
Online Surveys	70%	15%	0%	0%	8%	0%	7%
Online Forms	50%	29%	3%	1%	8%	0%	10%
Mobile Feedback	39%	8%	0%	0%	22%	5%	26%
Online Feedback Panels	31%	7%	3%	0%	9%	6%	44%
Internet Forums	20%	14%	2%	2%	7%	11%	46%
Crowdsourcing	17%	8%	1%	0%	8%	10%	56%



Note: Due to the small numbers, agencies reporting they would "*Stop Using*" tools are not shown in the figure.

Figure 17 "How do you anticipate your use of the following web-based tools will change over the next five years?"

Anticipating how agencies will continue to use tools brings out an interesting question regarding how they perceive web-based tools usage based upon the benefits and drawbacks they associate with using them. Agencies responses to benefits and drawbacks (see Figure 12 and Figure 14) associated with web-based tools were compared to their responses to Figure 17 "*How do you anticipate your use of the following web-based tools will change over the next five years?*". As has already been noted, a statistically significant relationship was found indicating that larger agencies use mobile applications more than smaller agencies. Looking at potential reasons why this is, the responses collected from Figure 17of "*Use More*", "*Will Start Using*", "*Use Less*", or "*Stop Using*" for mobile applications were compared to the benefits and drawbacks addressed by the agencies.

Table 8 Analyzing Future Usage of Web-based Feedback Tools Against Associated Benefits and Drawbacks

"How do you anticipate your use of the following web-based tools will change over the next five years?"			
# of Agencies Responding on Use of Mobile Applications - 127			
Potential Correlations to Benefits Associated	# of Agencies stating "Use More" or "Will Start Using" Mobile Applications	**Potential Correlations to Drawbacks Associated**	# of Agencies stating "Use Less" or "Stop Using" Mobile Applications
	78		6
Increases Ability to Provide Positive Feedback	67 (85%)	Difficult to Comply with Archiving, Record Keeping Requirements	3 (50%)
Enhances Agency Image	62 (79%)	Lack of Staff to Respond in a Timely Manner	2 (33%)
Cost Effectively Collects Feedback	60 (76%)	Lack of Management Support	1 (17%)
Real Time Information Allows Timely Responses	57 (73%)	Security Risks/Cyber Security Concerns	0
Easy to Implement Quickly	46 (58%)	No Process for Handling Feedback	0
Provides Specific Actionable Information	46 (58%)	Most Riders Don't Have Internet/Smartphones	0
Allows Interaction with Tech Savvy Riders	46 (58%)	Negative Feedback Could Affect Agency Image	0
Improves Ability of Special Populations to Provide Feedback	35 (44%)	Our Agency Limits Employee Access to Internet	0

Out of the 127 agencies that responded on their future use of mobile applications, 84 stated they would either "*Use More*", "*Will Start Using*", "*Use Less*", or "*Stop Using*" them, as seen in Table 8. Looking at the benefits associated with "*Use More*" and "*Will Start Using*", all benefits except improving the ability of special populations to provide feedback were associated at least 58% of the time with agencies planning to increase the usage of mobile applications. Looking at what drawbacks were associated with mobile web-based feedback, 50% of agencies saw difficulty to comply with archiving and record keeping as the biggest drawback. However, due to the few responses of agencies stating they would "*Use Less*" or "*Stop Using*" mobile applications, and the general lack of drawbacks associated with them, it is difficult to draw any conclusions about barriers to the increased usage of mobile apps. While

these correlations can help to explain why mobile applications are the fastest growing tool, they could also help to explain why larger agencies are keen on using them more than other agencies as they have realized their gainful benefits and few drawbacks.

5.7 Accessibility of Web-based Tools

Some tools are readily available to improve website accessibility for individuals with disabilities. Section 508[2] of the U.S. Rehabilitation Act provides accessibility requirements and standards that federal agencies are asked to follow. Common practices to ensure accessibility include closed captioning, visual contrast, adjustable text sizes, keyboard navigation for people with impaired mobility, and color schemes that color-blind readers can recognize.

When asked "*What does your agency do to make your agency's web-based tools accessible to transportation disadvantaged and Title VI populations*," 86% of the responding agencies selected at least one accessibility feature to help people use their web-based tools. The primary features included special formatting to support text readers for the visually impaired, site translators for persons with limited English proficiency, and variable text sizes (see Figure 18).

Some tools were not widely used, such as text-only tools and closed captioning. Use of tools like these is closely related to certain applications, specifically those with video or audio features, which may explain their more limited adoption.

Fourteen percent of the responding agencies did not use any form of accessibility feature on their web-based tools. Many email and social media sites have built-in features that do not require additional software of programming, including site translators and variable text size, and it is possible that agencies do not consider these built-in features "special tools."

[2] Section 508 Standards can be found online (http://section508.gov/index.cfm?fuseAction=stdsdoc)

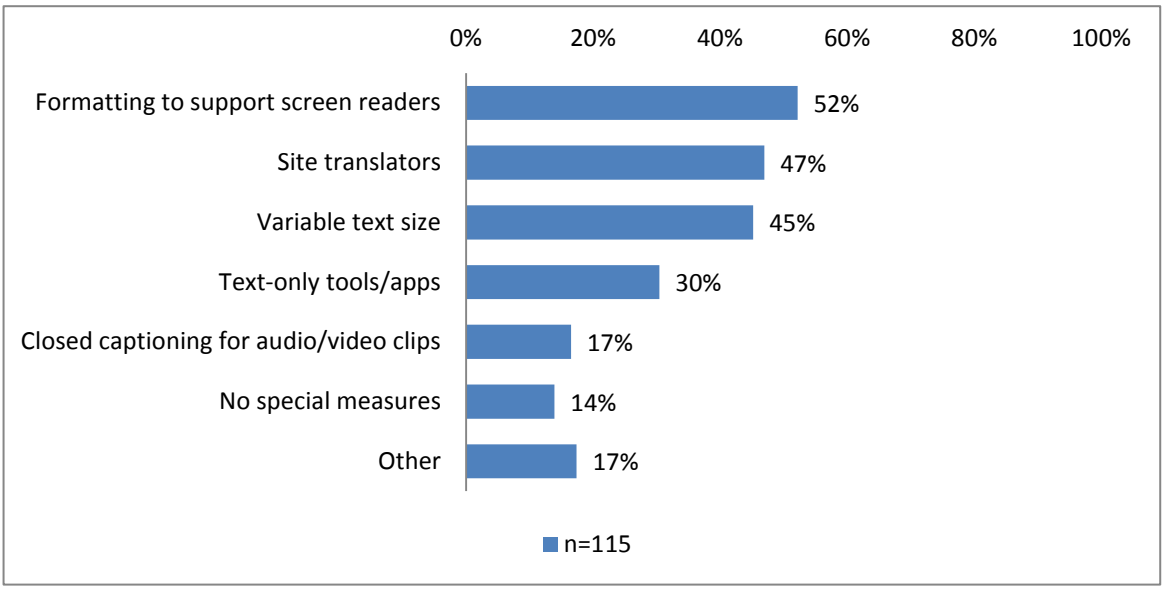
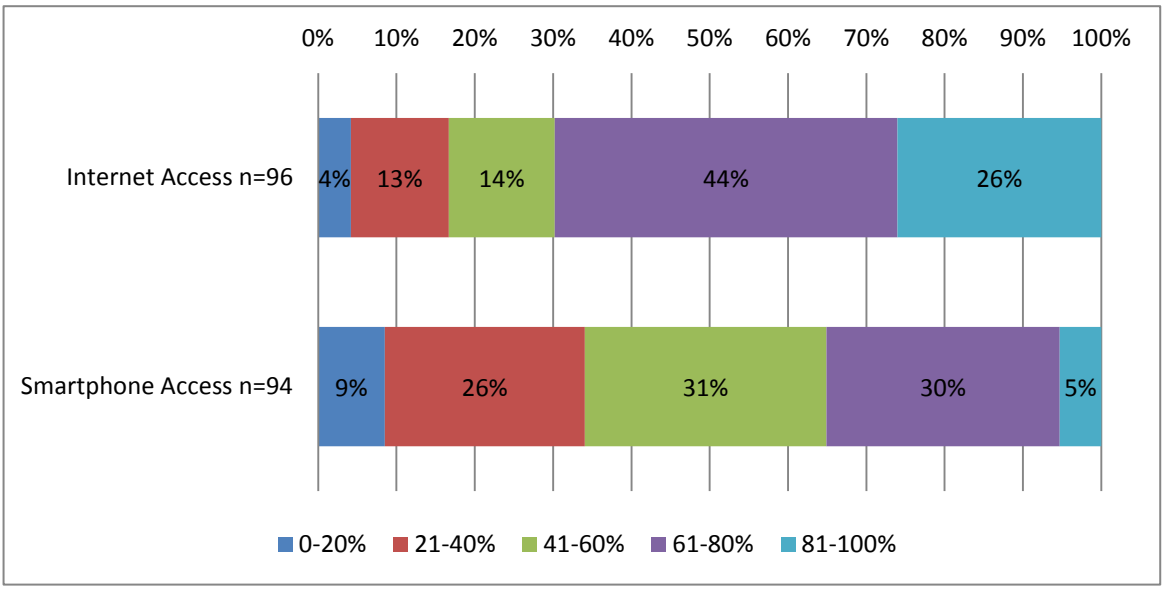


Figure 18 "What does your agency do to make your agency's web-based tools accessible to transportation disadvantaged and Title VI populations?"

5.8 Rider Access to the Internet and Use of Smartphones

An area of concern for agencies regarding web-based customer feedback tools is the percentage of the rider base that can access these tools via Internet or smartphone. Of the 127 respondents who answered the question, approximately one-quarter did not have an estimate of the percentage of their riders with access to the Internet or a smartphone. Of those who provided an estimate, 70% stated that at least 61% of their riders had access to the Internet and 35% stated that at least 61% of their riders had smartphones (see Figure 19).



Note: This figure does not include respondents that selected "Don't Know"

Figure 19 "What is the estimate of the percentage of your riders that have Internet access/smartphones?

Comparing responses based on agency size indicates that small agencies are more likely than large agencies to serve riders who are believed not to have access to the Internet or own a smartphone (see Figure 20 and Figure 21). Revisiting the first question proposed for this thesis, a chi-square test was performed to analyze the relationship between agency size and rider access estimates. It was found that the respondents estimates for internet and smartphone usage had a statistically significant positive relationship (Internet X^2=19.349, p = .036, Smartphone X^2=15.506, p = .05). Thus, larger agencies have greater estimates for Internet and smartphone access, with smaller agencies estimating fewer riders possessing these technologies. Looking closer, 13% of small agencies estimated that 20% or less of their riders had access to the Internet, with no medium or large agency estimating rider access that low. For smartphones, 19% of small agencies estimated that 20% or less of their riders had a smartphone while 6% of medium sized agencies and no large agency estimated such low smartphone ownership.

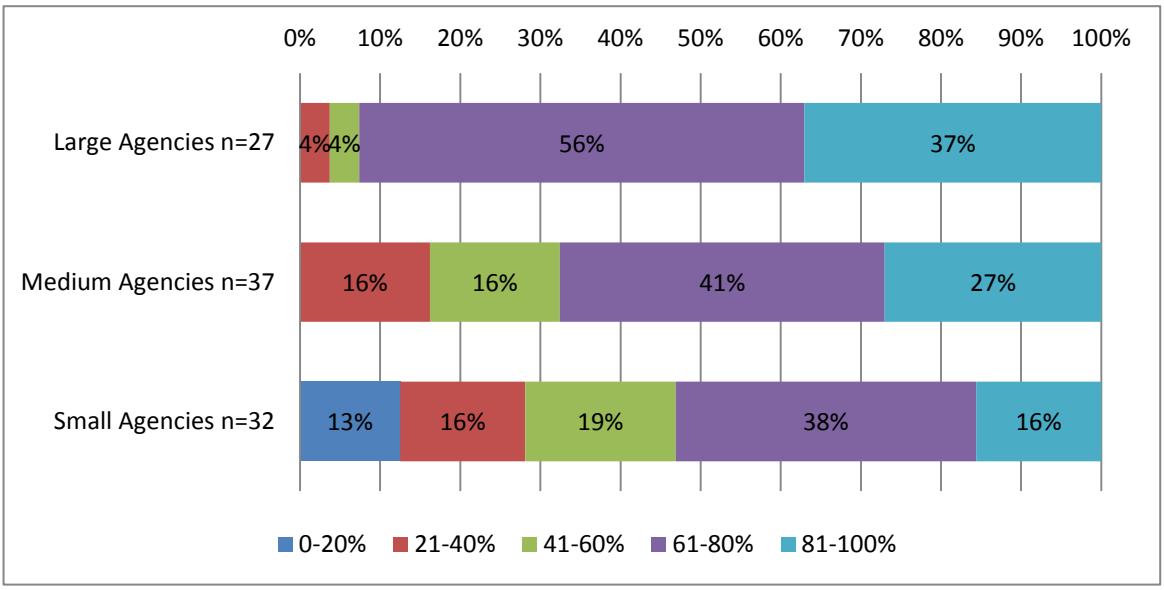


Figure 20 Agency Estimate of the Percentage of Riders that have Internet Access, by Size of Agency

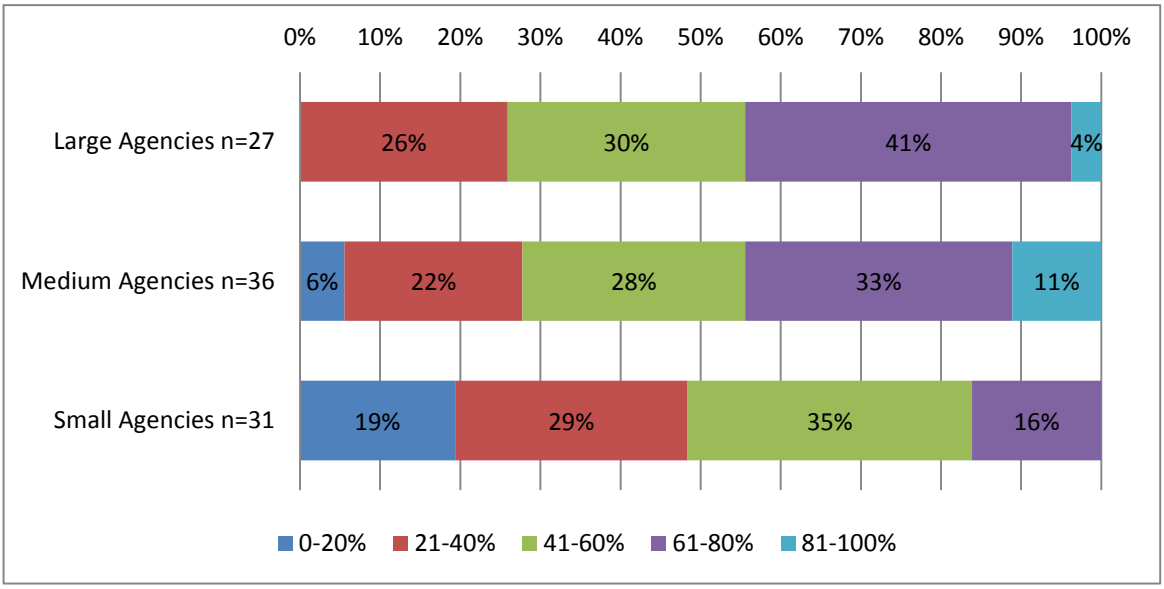


Figure 21 Agency Estimate of the Percentage of Riders that have Smartphones, by Size of Agency

Respondents were then asked "*What is the source of this estimate*?" The responses were nearly identical for Internet access and having a smartphone. Of those agencies that provided an estimate, over half (56%) said it was a staff estimate based on their knowledge of the customer base and over a quarter of the agencies had data based on an agency survey (see Figure 22).

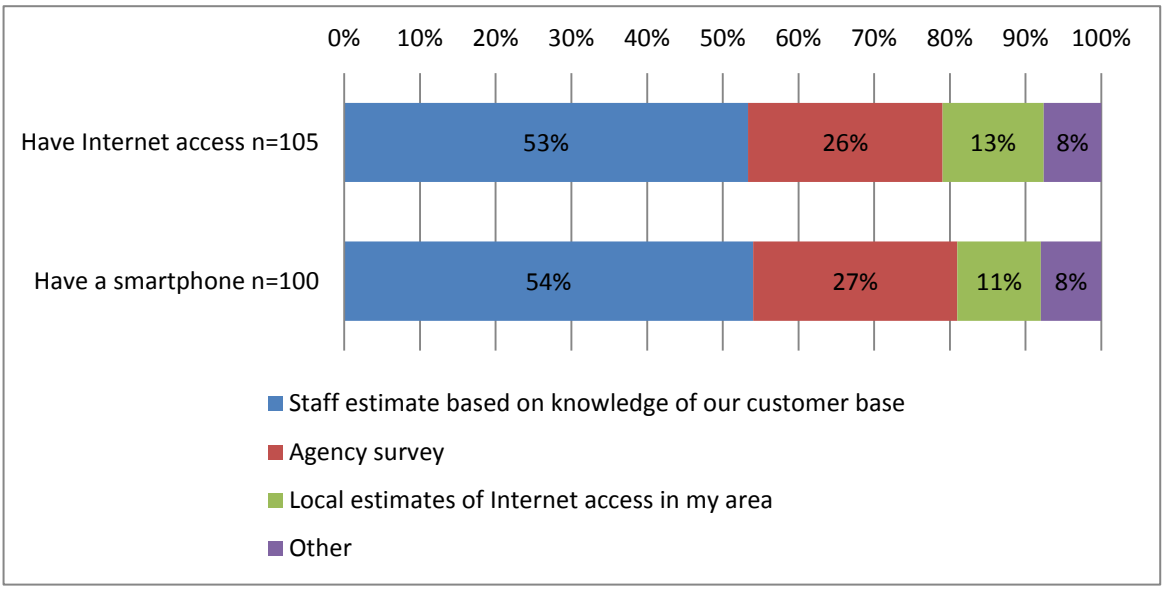


Figure 22 "What is the source of this estimate?"

After examining the survey, further analysis regarding the interaction of agency size and responses was conducted to discover the relationships that these components play in determining how web-based feedback tools differ in use by transit agencies today.

5.9 Survey Analysis and Comparisons

As was noted previously, mobile applications were found to be positively associated with larger agency size, as were higher estimates of riders with access to smartphones. Thus, additional analysis was conducted to better understand what might be attributed to this relationship. It could be proposed that there are associations between agency size, mobile application usage, and estimates for riders possessing smartphones (considering mobile apps can only be accessed via smartphones).

The first part of this test involved grouping of percentages of rider smartphone access to be compared to the response from the agency regarding whether or not they used mobile applications as a web-based tool. The chi-square test showed that the estimated number of transit riders with access to smartphones compared against each agencies usage of web-based feedback tools was not significant at

the 5% level, and thus mobile applications are being used equally amongst rider groups with differing smartphone access (X^2=2.353, p = .671).

Because there could still be a relationship between agency size, mobile application usage, and rider access to smartphones, a two-way ANOVA was performed (Table 9). With dependent variable mobile applications and independent variables smartphone access and agency size, the test was performed asking if an agencies mobile applications usage is dependent on its size and rider access to smartphones.

Table 9 Two-Way ANOVA for Mobile Apps, Agency Size, and Smartphone Access

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2.610[a]	12	.217	1.762	.069
Intercept	2.161	1	2.161	17.513	.000
Smartphone Access	.322	4	.080	.652	.627
Agency Size	1.912	2	.956	7.744	.001
Smart * Agency Size	.749	6	.125	1.012	.423
Error	9.997	81	.123		

Two-Way ANOVA Model R Squared = .207

From the model, there was no statistically significant difference in mobile application usage and the levels of riders smartphone access (p = .627), but there was a statistically significant difference between mobile applications and agency size (p = .001), as could be seen before with the chi-square test. The test revealed an interaction of smartphone access and agency size, F (6 d.f.) 1.012, p = .423. Since the p-value was greater than .05, there is no statistically significant interaction. Therefore, though mobile applications are used more by larger agencies, it is not due to larger agencies reporting higher

rider access estimates to smartphones. As such, there may be other reasons why larger agencies use mobile applications more often than others which will be explored further.

5.9.1 Predictors for Web-based Tools Usage

Regarding the second question proposed for this study, agency responses were collectively analyzed for determining the number of tools being used by agencies today. Previously, it was found that the number of tools being used by each agency had a statistically significant relationship with agency size. Though larger agencies may use more web-based feedback tools, what additional variables may be causing this?

To gain a better understanding of how agency perceptions within the survey affect the number of web-based tools being used by agencies, factorial regression models were constructed with agency attributes as explanatory variables. Through these regressions, the relationship between different attributes and how they contribute to whether or not agencies will use web-based feedback tools can be recognized. The first factorial regression model used the number of web-based feedback tools each agency employs as the dependent variable, tested against several attributes assumed to impact this. From the regression, It was found that small agencies and the number of associated benefits agencies perceive from using web-based tools were found to be statistically significant, as can be seen in Table 10 ($\beta = -.709, p = .049, \beta = .131, p = .045\ respectively$) .

Table 10 Factorial Regression For Number of Web-based Feedback Tools Used

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.024	.516	-	5.860	.000
	Small Agency	-.709	.355	-.244	-1.995	.049
	Medium Agency	-.435	.302	-.172	-1.438	.154
	Large Agency	BASE CASE				
	Number of Associated Drawbacks	.174	.108	.162	1.618	.109
	Number of Associated Benefits	.131	.065	.203	2.031	.045
	Approximate Full Time Employees Required	.012	.007	.172	1.679	.097

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.671[a]	.450	.387	.283

The remaining variables were not found to be statistically significant. However, from the variables identified, this test indicated that for smaller agencies there is a negative association for incorporating web-based feedback tools. At the same time, the number of benefits agencies associate with web-based feedback tools was positively associated with the number of web-based feedback tools used by that agency.

As had been noted earlier in the analysis, "*Most of our Riders don't have Internet/smartphones*" was found to be negatively associated with agency size, indicating that smaller agencies were more likely to identify with this drawback. Though the number of associated drawbacks wasn't found to be statistically significant in the previous factorial regression model, another factorial regression was conducted maintaining the same dependent variable analyzed against the effects of the drawbacks listed in Figure 14.

As was assumed, it was found that "*Most of our riders don't have Internet/smartphones*" was statistically significant, indicating that agencies reporting this drawback are negatively associated with using web-based feedback tools ($\beta = -.997, p = .018$) . As can be seen in Table 11, no other drawback was found to be statistically significant. It is interesting that this drawback was the only significant finding, and leads to the third question in the following section regarding inaccurate estimates of rider accessibility to certain tools. For example, when comparing responses of smaller agencies identifying with this drawback against their riders' estimate to Internet and smartphones, it was found that half of the agencies actually reported 15% of their riders having more than the national average for Internet access, and 66% of their riders having more than the national average for smartphone access. This indicates that though smaller agencies are positively associated with reporting this drawback, their rider access estimates to both technologies are not in line with this response.

Table 11 Factorial Regression – Dependent Variable Number of Tools Used

Associated Drawbacks		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.276	.312	-	10.492	.000
	Potential Negative Feedback	.050	.309	.016	.160	.873
	Lack of Staff	.329	.316	.103	1.043	.300
	Lack of Management Support	.477	.491	.101	.972	.334
	Most of our Riders Don't Have Internet/Smartphones	-.997	.414	-.230	-2.410	.018
	No Process for Handling Feedback	.514	.432	.122	1.191	.237
	Our Agency Limits Employee Access to Internet	.837	.527	.165	1.588	.116
	Security Risks	.524	.403	.127	1.300	.197
	Difficult to Comply with Requirements for Storage	-.296	.330	-.091	-.897	.372

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.378[a]	.143	.073	1.493

Along with the associated drawbacks, the same factorial regression was analyzed for the benefits associated with web-based feedback, as seen in Figure 13. From Table 12, no benefits were found to be statistically significant, indicating that it is not possible to pinpoint any perceived benefits as potentially increasing or decreasing the number of tools that an agency may utilize.

Table 12 Factorial Regression – Dependent Variable Number of Tools Used

Associated Benefits		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.284	.631	-	3.619	.000
	Easy to Implement	.173	.346	.053	.498	.619
	Cost Effective	.535	.413	.135	1.294	.199
	Provides Actionable Data	.460	.340	.142	1.352	.179
	Real Time Info Allows Timely Responses	.269	.381	.074	.707	.481
	Allows Interaction with Tech Savvy Riders	-.168	.342	-.053	-.491	.624
	Enhances Agency Image	.272	.435	.066	.625	.534
	Improves Connection with Special Populations	.107	.330	.035	.324	.747
	Increases Feedback Provision for All Riders	.068	.520	.012	.130	.897

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.306[a]	.093	.024	1.531

Considering the story that has been woven here, a trend has started to identify itself through the responses analyzed. Larger agencies are positively associated with higher estimates of rider access to both Internet and smartphones and using more web-based feedback tools, especially mobile applications. At the same time, smaller agencies are positively associated with citing the common drawback *"Most riders don't have Internet/smartphones"*. This same drawback, along with smaller agencies, is negatively associated with using web-based feedback tools. Yet from the finding that most small agencies reporting this drawback actually had higher rider estimates for smartphones than the national average, it brings up the question of whether agencies are accurately measuring their riders' access to technology.

5.9.2 Analyzing Responses to Rider Accessibility Estimates

If agencies of all sizes are incorrectly gauging rider estimates for Internet and smartphones, yet use these estimates to indicate how many web-based feedback tools they should use, which tools they should focus more on (web-based or mobile-based), or if they shouldn't be using certain tools at all, they could potentially be basing their web-based feedback system guidelines on incorrect data.

To test the third question proposed in this thesis, data on national population accessibility estimates to Internet and smartphones as collected from the Pew Research Center and the U.S. Census Bureau studies was utilized (28, 29). The U.S. Census Bureau has employed amendments to its Current Population Survey (CPS) to survey additional questions regarding the U.S. populations' access to Internet and smartphones, while the Pew Research Center collects data on Internet and smartphone usage as part of its American Life Project. The purpose of this comparison was to analyze agency responses against comparable regional estimates for Internet and smartphones access. The first test examined the average agency reported percentage of rider access to Internet and smartphones against national averages for the U.S., as seen in Table 13.

Table 13 Agency Size Comparison of Internet/Smartphone Access

Survey Results	Riders with Internet Access	Riders with Smartphone Access
All Agencies	65%	50%
Large Agencies	75%	54%
Medium Agencies	65%	54%
Small Agencies	56%	40%
National Average - United States	86%	56%

Examining the table, it can be seen that large, medium and small agencies all underestimated their riders' access to Internet as compared to the U.S. average of 86%, with large agencies coming closest with an average response of 75% access for their riders. For smartphones though, only small agencies greatly underestimated their riders' access when compared to the national averages, as large and medium agencies came within 2% of the actual result.

Table 14 Comparison of Agency Size against State Census Tract Internet Access Estimates

Large Agency Reporting's	Internet			
	More Than	Equal To	Less Than	Totals
Agency Survey	4	0	7	11
Local Estimate	3	0	6	9
Staff Estimate	3	0	4	7
Other	0	0	0	0
Medium Agency Reporting's				
Agency Survey	4	0	7	10
Local Estimate	0	0	4	4
Staff Estimate	4	0	15	19
Other	1	0	1	2
Small Agency Reporting's				
Agency Survey	1	0	4	5
Local Estimate	0	0	1	1
Staff Estimate	4	0	22	26
Other	0	0	0	0
Totals	24	0	71	95

Breaking the comparison down by agency size, the responses were compared against state-wide Internet and smartphone access rates, with each agencies response being compared against its states estimated access (List of states and agency access comparisons can be seen in Appendix C). The responses were categorized as being either "*More Than*", "*Equal To*", or "*Less Than*" the agencies state's average reported estimate of Internet Access, with the results in Table 14. For example, Triangle transit, with rider access to Internet estimated at 80-100%, is located in North Carolina, with a statewide access to Internet reported to be equal to 80%. Therefore, Triangle Transit would be *"More Than"* the state estimate for Internet access. 25% of agencies reported "*More Than*" their statewide average, while 75% reported "*Less Than*" their statewide average, solidifying the notion that transit agencies may have been under-representing their estimates not only compared to the national level, but also on a state-by-state basis. Reasons for this could stem from the methods used by each agency to estimate rider access.

Looking at the responses in the table again, 55% of the responses were based off staff estimates for rider access to the Internet, while only 27% were based off of actual agency surveys of their riders. However, even for those instances where agencies surveyed their population, 70% of the agencies using surveys still predicted "*Less Than*" the state access level for rider access to Internet.

Table 15 Comparison of Agency Size against State Census Tract Smartphone Access Estimates

Large Agency Reporting's	Smartphones			
	More Than	Equal To	Less Than	Totals
Agency Survey	5	1	1	7
Local Estimate	4	0	0	14
Staff Estimate	3	8	4	16
Other	0	0	0	0
Medium Agency Reporting's				
Agency	4	2	4	10
Local	1	2	1	4
Staff	3	8	11	22
Other	0	1	1	2
Small Agency Reporting's				
Agency	5	2	3	10
Local	0	2	0	2
Staff	8	3	6	17
Other	0	0	1	0
Totals	33	29	32	94

Repeating the same comparison for smartphones in Table 15, there was an even distribution of responses, with 35% stating "*More Than*", 30% stating "*Equal To*", and 34% stating "*Less Than*". 64% of agencies reported that their riders had *"Equal To"* or *"More Than"* their states respective estimate of access to smartphones. Interestingly, 59% of these estimates were based off of staff estimates again, yet were apparently more accurate than the Internet access estimates. The reasons for this might be hard to predict, as there is little additional information to go off of. Further discussion will be provided in the summary section.

5.9.3 Analysis of Agency Rider Access to Internet/Smartphone using Urbanized Areas

A second test moved from a regional focus to analyzing the effects of comparable urbanized sizes in relation to accessibility estimates. Data from the Pew Research Center on Internet and smartphone access based on Urban, Suburban, and Rural areas was compared against urbanized agency sizes, as can be seen in Table 16 (28).

Table 16 Urbanized Agency Size Comparison of Internet/Smartphone Access

	Riders with Internet Access	Riders with Smartphone Access
Urban Areas	81%	56%
Suburban Areas	84%	57%
Rural Areas	74%	38%
National Average - United States	86%	56%

For both Internet and smartphones, suburban areas tend to have a higher rate of access to both technologies than other urbanized areas. Referencing Figure 23, urbanized agency responses for rider Internet access was compared against comparable urbanized city sizes for Internet access. In this instance, Triangle Transit is classified as a suburban agency. With its estimated rider access to Internet being 40-60%, this would be classified as *"Equal To"* the average suburbanized areas access to Internet. In each case (urban, suburban and rural), transit agencies frequently reported that their riders had less Internet access than the U.S. average for comparably sized urbanized areas. For Internet, 58% of agencies reported that their riders had less than the comparable urbanized areas access.

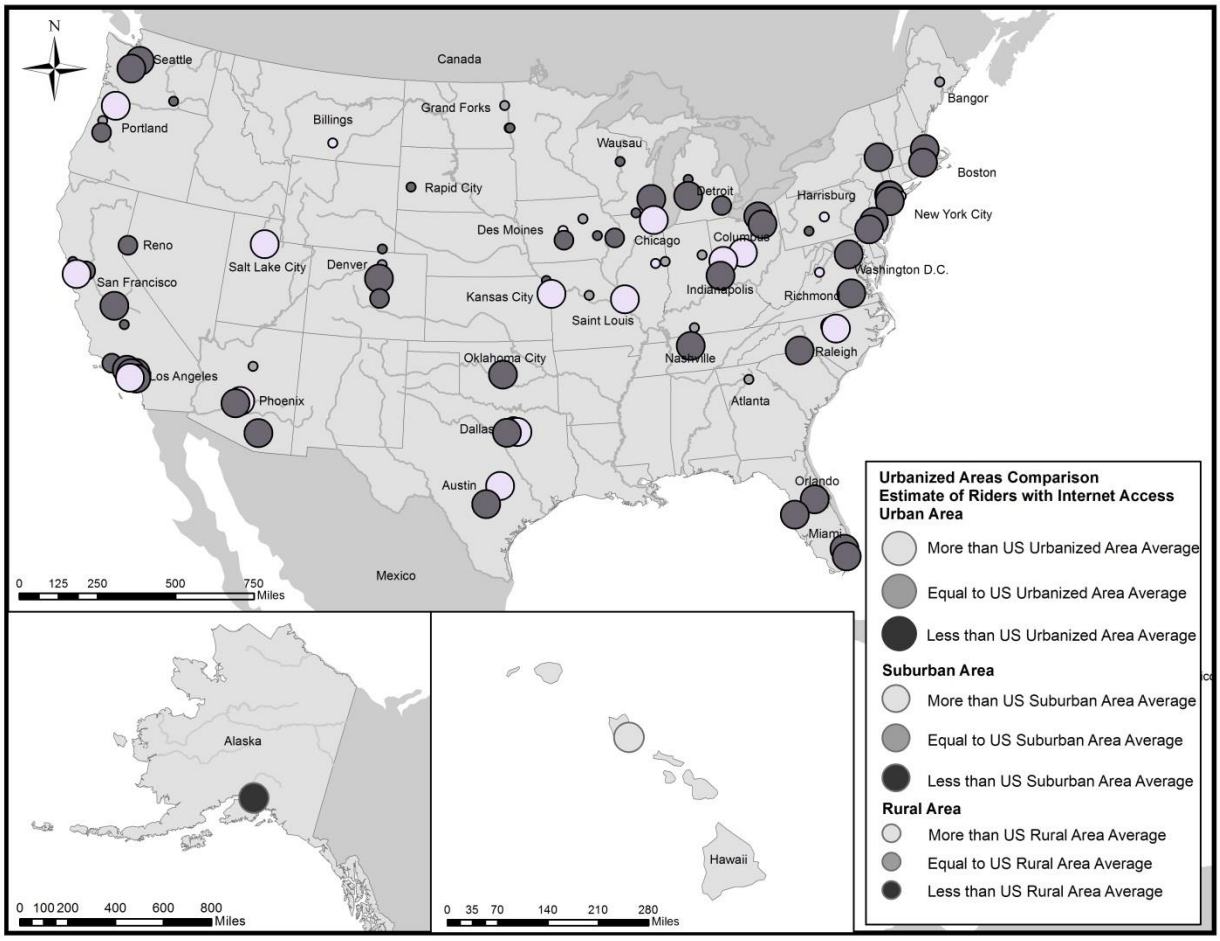


Figure 23 Transit Agency Rider Internet Access Urban Comparison

Looking at urbanized differences for smartphones in Figure 24, the results were slightly different, as 74% of urban transit agencies had "*Equal To*" or "*More Than*" the U.S. average for smartphone access when compared against comparably sized urbanized areas. Thus, only 26% of transit agencies stated that their riders had *"Less Than"* their comparable urbanized areas smartphone access. Overall, for both tests, there has been a trend for agencies to evenly predict their riders' access to smartphones, while at the same time, agencies tend to under-estimate their riders' access to the Internet. However, since most agencies are using the same methods to estimate rider access, it is surprising that access for both technologies differs so greatly.

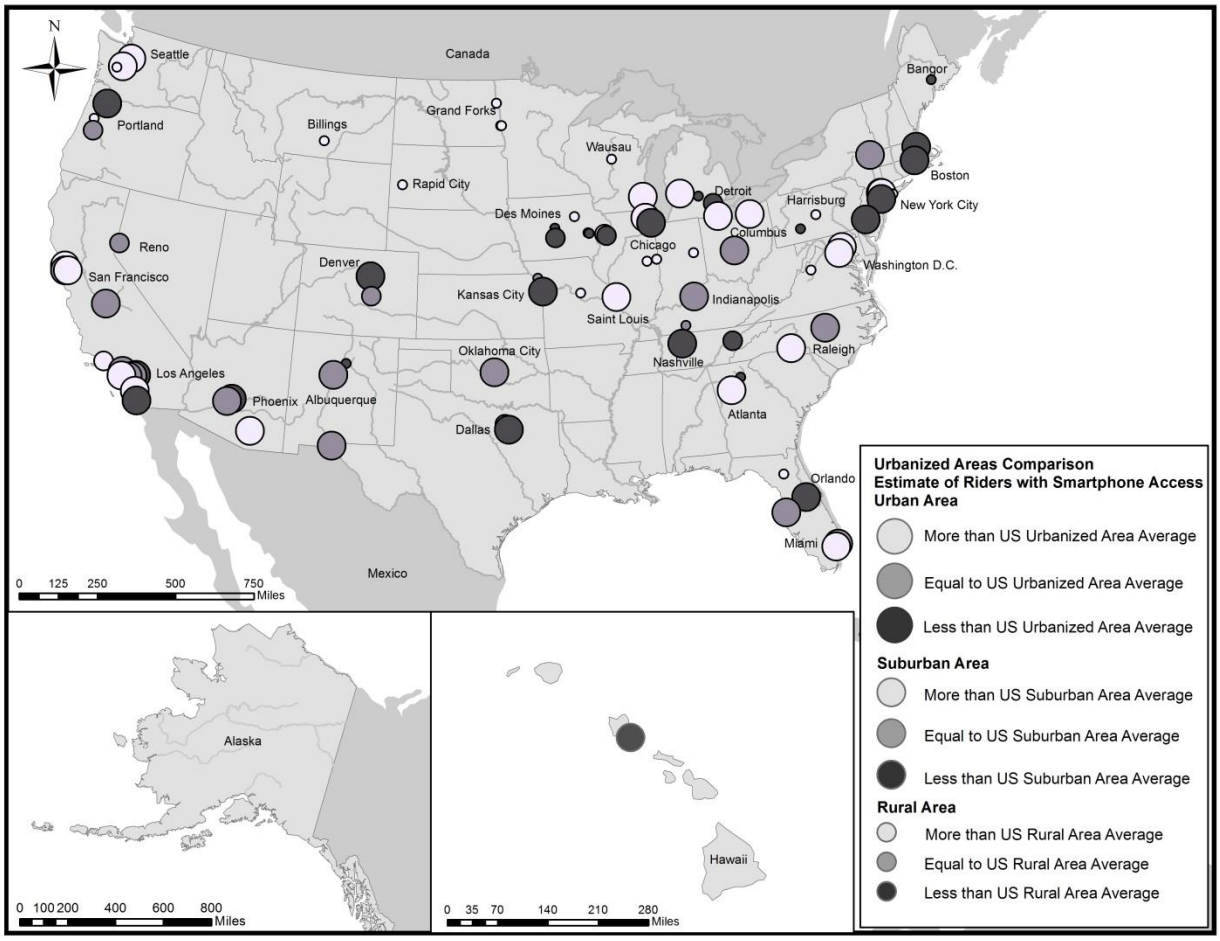


Figure 24 Transit Agency Rider Smartphone Access Urban Comparison

5.9.4 Analyzing Survey Method Differences

Regarding the accuracy of transit agency estimates, the methods used by transit agencies to solicit rider information on Internet and smartphone access were found to primarily stem from staff estimates based on knowledge of their customers, as can be seen in Table 17.

Table 17 Rider Accessibility Estimates By Agency Size

	Rider Internet Estimate	Agencies that Reported "Less Than" National Average	Rider Smartphone Estimate	Agencies that Reported "Less Than" National Average
Staff Estimates Based on Knowledge of our Customer Base	55%	43%	59%	22%
Agency Survey	27%	19%	29%	1%
Local Estimates of Internet/Smartphone Access in my Area	18%	12%	12%	1%

More than half of the surveyed transit agencies answered that estimates were based on "*Staff Estimates based on Knowledge of our Customer Base*", indicating that perhaps most agencies are not actually fully aware of their customer base's access to either smartphones or Internet. Additionally, 43% of those agencies that used staff estimates had estimates "*Less Than*" the national average for Internet and 22% had estimates "*Less Than*" the national average for smartphones. Agency surveys and local estimates were less likely to respond "*Less Than*" the national averages, as these methods may lead to greater representation of the actual transit riding population.

Even when comparing the responses against their comparable urbanized estimates for Internet and smartphone access, it was found that for staff estimates 40% of Internet and 19% of smartphone estimates were "*Less Than*" the comparable urbanized area access rates (see Table 18). Once again,

agency surveys and local estimates were far more likely to accurately represent riders' true access to Internet and smartphones.

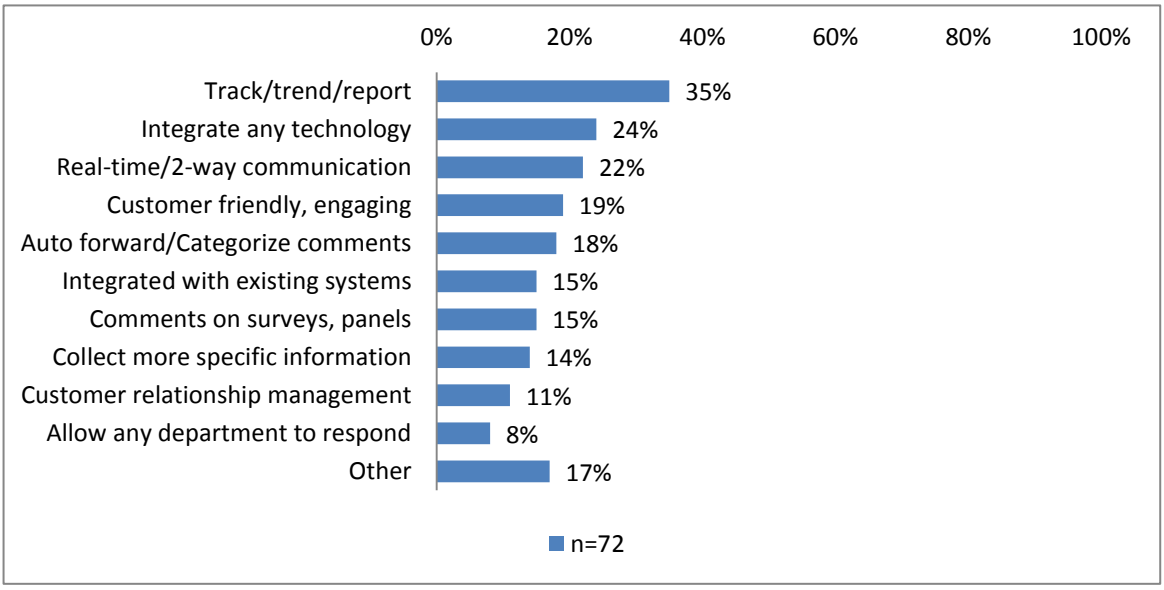
Table 18 Rider Accessibility Estimates by Urbanized Size

	Rider Internet Estimate	Agencies that Reported "Less Than" National Average	Rider Smartphone Estimate	Agencies that Reported "Less Than" National Average
Staff Estimates Based on Knowledge of our Customer Base	57%	40%	54%	19%
Agency Survey	26%	18%	30%	9%
Local Estimates of Internet/Smartphone Access in my Area	14%	11%	12%	1%

Therefore, regardless of how agency responses are compared against national, state-level, or urbanized access estimates for Internet and smartphones, the same findings have come forward. Transit agencies have typically under-estimated their riders access to Internet, while evenly assessing their riders' access to smartphones between all three groups. However, no apparent reason was identified from the survey for these findings, other than noting that most estimates were based off of staff estimates rather than transit agency conducted surveys of their riders.

5.10 Final Thoughts on Using Web-based Feedback Tools

For the overall survey, respondents were asked to imagine the ideal web-based customer feedback system for their agency. They were asked to indicate what they would like to see, how it would operate, and what types of feedback they would receive. There were 72 respondents who provided comments about their ideal system. Comments were categorized into general topic areas that reflected the most common responses (see Figure 25). The most desired feature, mentioned by 35% of the agencies, was the ability to track, monitor, and report on customer feedback. The next most mentioned features were the ability to integrate comments across all technologies (e.g. social media, mobile application, email), and ability to have real-time, two-way conversations with customers (24% and 22% of agencies, respectively).



Note: Multiple responses allowed; comments not related to online customer feedback systems were excluded.

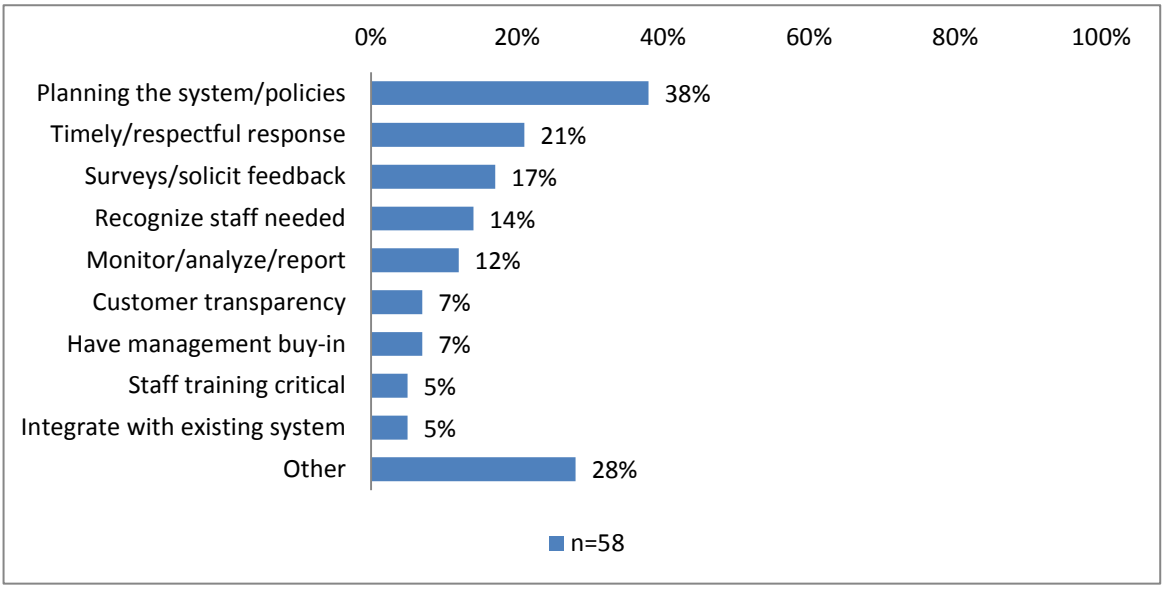
Figure 25 "Imagine for a minute the ideal web-based customer feedback system for your agency. What would your agency like to see? How would it operate? What type of feedback would you receive? Please describe your desired system."

5.10.1 Lessons Learned

Additionally, survey respondents were asked to share "*any lessons learned which would benefit other transit agencies that are considering implementing web-based customer feedback tools*." The most common comments were related to internal planning and policies (see Figure 26). Example comments include:

- Have an overall roadmap for your digital efforts. Do not react all the time- be proactive.
- Match your ability to manage and respond to comments to your resources - choose the media that is most readily available to your customers.

The next most common topics were related to timely and respectful responses to comments. Agencies stressed the importance of responding to feedback honestly and in a timely manner.



Note: Multiple responses allowed

Figure 26 "Do you have any lessons learned which would benefit other transit agencies that are considering implementing web-based customer feedback tools? What is the most important lesson?"

Chapter 6 Discussion

Overall, many connections have been drawn from the analysis of the survey conducted. Considering the information gathered, there are still shortfalls in fully understanding how these findings impact the use of web-based feedback tools. Though the survey focused on multiple aspects of the web-based feedback system, the analysis shifted to focusing on the aspect that transit agencies may not be properly estimating their riders' access to Internet and smartphones. Without properly understanding their own transit riding populations' ability to access the very tools they are creating, transit agencies could be creating systems that potentially end up under, or over, utilized. This summary will provide analysis of the survey overall, while also attempting to understand differences identified in reporting rider access estimates for both Internet and smartphones.

6.1 Survey Analysis Discussion

Regardless of the type of feedback, transit agencies see the benefits of web-based customer feedback, with the primary downside being the lack of staff resources needed to support the systems and agencies believing most of their rider's don't have Internet or smartphone access. An element of concern about staff resources is the expanding number of options for web-based feedback, as evidenced by the fact that almost no agencies stated they would reduce or "*stop using*" any of these tools over the next five years. The growing number of tools that need to be managed is a concern that is reflected both in the "*drawbacks to web-based feedback*" (see Figure 14) and in the comments about an ideal system and lessons learned (see Figure 26). Transit agencies see that the keys to managing these systems are planning, integration, and automation.

While managing the web-based tools is an important aspect to agencies, additional findings from the analysis of the survey point out that most agencies don't truly understand the level of access

their riders' have to either Internet or smartphones. These estimates are essential for understanding how many transit riders each agency has can gain access to the web-based feedback tools provided. In a general sense, agencies could be basing their web-based needs, resources, and staff focuses on potential tools that their riders' may or may not even be able to utilize.

While it is important for agencies to understand how they will gather, use, and reply to the feedback they receive, it is just as important to create a web-based feedback system that is in line with their riders' accessibility to technology, and within their ability to use it. Planning for the system recognizes that web-based customer feedback is now a standard method of communication. But they must also recognize that up-to-date information about rider access to technology is also essential for engaging riders on the correct platforms.

6.2 Primary Major Findings

Initially, three questions were proposed to further analyze the results this survey found with regard to web-based feedback tools. The first question dealt with understanding the differences between agency sizes and their different usage of web-based feedback tools, hypothesizing that larger agencies would use more tools, especially mobile applications. In relation to this, a follow-on question evaluated what other variables might be affecting the usage of web-based feedback tools, based on agency responses to the survey. Lastly, rider access to smartphones and Internet were investigated, especially considering agencies' ability to determine their riders' access to the technologies being discussed.

The analysis has shown that larger agencies are statistically associated with using more web-based feedback tools than smaller agencies, especially regarding mobile applications. Additionally, further chi-square tests found a positive association between larger agencies, as defined by unlinked

trips, and higher agency estimated access for riders' to both smartphones and the Internet. On the opposite end, smaller agencies were found to be statistically associated with identifying the drawback "*Most of our riders don't have access to Internet/smartphones",* while also being negatively associated with using web-based feedback tools.

The TCRP B-43 report is seeking to create a tool-kit to help transit agencies understand how to implement and use web-based feedback tools through case studies and 'best practice' reviews. However, these findings suggest that there are differences in how agencies use such tools based on their size, either due to funding, staff, or other variables. At the same time, all agencies should take into consideration that every agencies' rider population is different, with various demographics, access to technology, and regulations affecting their ability to successfully copy any results found by other agencies using certain web-based feedback tools.

Following this, the number of web-based tools that agencies are using today, addressed through question two of this thesis, is statistically associated with agency size, the number of benefits associated with web-based tools, and agencies responding *"Most riders don't have Internet/smartphones".* Large agencies were again found to be positively associated with using more web-based tools, while the only benefit or drawback statistically significant for using more web-based feedback tools was *"Most riders don't have Internet/smartphones"*. There were no clear reasons from this survey that indicated what caused larger agencies or benefits to be associated with using more tools, but the drawback found here helped lead to a bigger finding in question three.

Though smaller agencies are positively associated with identifying that "*Most of our riders don't have Internet/smartphones*", half of these smaller agencies were found to actually report that 15% of their riders had more than the national average for Internet access (86%), and 66% of their riders had more than the national average for smartphone access (56%). A transit agencies' ability to gauge their

riders' ability to interact with them via web-based feedback tools requires knowledge of their riders' access to technology and needs concerning communication methods. As has been found before in the survey analysis, rider estimates are not matching up with national, statewide, or urbanized area access rates to Internet and smartphones. The main clear reason for this comes from the knowledge that estimates of rider access to smartphones and the Internet were not entirely based on agencies' own rider surveys, but rather a majority (70%) were from staff estimates based off knowledge of their riders and local area findings. Therefore, the most important finding in this thesis is that agencies do not have a good understanding of their riders' access to technology.

One possible explanation for why agencies are under-estimating their riders' access to the Internet could be that transit riders have less access to the Internet than the general population. However, a previous study found that four major transit agencies who do collect information on technology available to riders, their reported rider access to Internet and smartphones was found to be equal to or higher than local urbanized area access rates (30, 31). This signifies that riders were actually more likely to be more tech savvy than the general population, rather than less.

6.3 Future Research

There are several areas where future research could help to analyze potential missing links in this analysis. The first area relates to the actual benefits of using web-based feedback tools. Escaping the notions of survey methods and accessibility estimates, this study did not focus on the efficiency, interaction, or service components of web-based feedback, especially when compared against older, traditional methods previously incorporated by transit agencies. Potential questions to explore could include noting if employees are more responsive to customers online, if cost is truly reduced by using web-based feedback tools, and what are the tradeoffs of using web-based feedback systems instead. At the same time, transit riders' opinions on using these web-based feedback tools could answer questions

regarding their satisfaction using them, if they perceive getting better service from them, and how their interaction with transit agencies has changed since using them.

Secondly, there is a need to understand how agencies use rider Internet and smartphone access estimates to plan their web-based feedback systems, including deciding how many tools they will incorporate, which types of tools they will use, and how this will impact their ability to reach their riders. Their use of such estimates could determine how many agencies are designing web-based feedback systems that not only fail to fit with their riders' technological capabilities, but may also fail to satisfy their riders' needs for specific tools. Therefore, one of the primary recommendations for this thesis is for agencies to further pursue greater understanding of their riders' preference of web-based tools and access to technology. One possible way to implement this is to include questions about access to technology on their rider surveys, as well as questions regarding which tools are most effective for riders to both give and receive feedback.

Chapter 7 Conclusions

This thesis investigated the methods by which agencies are using web-based tools to interact with their riders today and into the future. The increased ownership of smartphones and access to the Internet in recent years has allowed web-based feedback tools to reach a greater population of transit riders, subsequently allowing online interactions between transit agencies and the public to grow and benefit the quality of transit service being offered.

Through the survey conducted in this study, over 130 transit agencies across the United States and Canada were solicited for their response relating to how they are using web-based feedback tools today. The responses have covered information regarding web-based tools being used, web-based feedback types being received, feedback collection, feedback sorting, and the benefits and drawbacks associated with the use of such tools. Today, transit agencies are regularly finding themselves concerned with unsolicited feedback; collecting, handling, analyzing, and responding to it. In addition, they have found many benefits associated with these tools, while primarily only acknowledging the drawback of lack of staff as a main concern. While these aspects of the survey are important for understanding how transit agencies utilize web-based feedback, the survey has helped to uncover a concern that transit agencies are currently not accurately assessing their riders' access to Internet and smartphones.

From chi-square tests conducted, it was found that larger agencies, based on unlinked trips, are positively associated with using more web-based feedback tools, employing mobile applications, and having higher estimates for riders' accessing both Internet and smartphones. Alternatively, it was found that smaller agencies are negatively associated with using web-based feedback tools, and positively associated with state that *"Most of our riders don't use Internet/smartphones"*. Factorial regression models cemented these findings, indicating that the same drawback ("*Most of our riders don't use*

Internet/smartphones") was found to be statistically significant against the dependent variable *"number of web-based feedback tools used"*, indicating that small agencies are potentially using less web-based feedback tools due to having fewer riders with access to Internet and smartphones.

Furthermore, when comparing the small agencies stating *"Most of our riders don't use Internet/smartphones"*, the majority of agencies were found to under-estimate their rider access to Internet, while evenly estimating *"More Than"*, *"Equal To"*, and *"Less Than"* for their estimates of rider access to smartphones. From this, further comparisons between agency responses and national, statewide, and urbanized area estimates for access to Internet and smartphones were conducted. Overall, it was found that the trend for under-estimating Internet access and equally estimating *"More Than"*, *"Equal To"*, and *"Less Than"* for rider access to smartphones was prevalent. In the end, more than half of all the agency estimates were found to have been taken by staff estimates, with only a quarter coming from transit rider surveys. Since the majority of agency estimates carried out through staff estimates were inconsistent with national data from the U.S. Census Bureau and Pew Research Center, it can be assumed that the primary cause for these discrepancies is due to agencies lacking exact survey measurements of their transit riding population.

While from 2010 to 2013 there was an increase of 81% in Americans owning smartphones, the same time saw an increase of 10% in Americans having access to the Internet (28, 31). In this case, agency surveys or estimates made three, or even one, years ago would likely be outdated. With smartphone and Internet access rapidly advancing, their growth could throw estimates off. Once again, the finding reflects a need for agencies to adopt better methods for surveying their riders regarding technology usage.

As the survey identified agencies concerning themselves primarily with gathering, analyzing, and responding to web-based feedback, they may be lacking the ability of focus on the smaller aspects of

web-based feedback systems. Considering the possibility that agencies use rider estimates to plan their use of web-based feedback tools, doing so without accurate rider knowledge is unfortunate. Transit agencies must understand that without proper understandings of which technology is being utilized most by their customers, they will fail to connect with them on the right medium. Empowering agencies with knowledge on their riders benefits all involved in the web-based feedback process, and helps riders know that transit agencies are actively planning with them in mind. As Internet and smartphone access rates continue to climb over the next several years, agencies should take note and allocate their resources to meet these trends to ensure they will be able to address their riders' needs over the coming years.

Appendix A: Web Survey

Web-Survey Consent Information Sheet

You are being asked to be in a research study about your transit agency for a project sponsored by the Transit Cooperative Research Program. The purpose of this study is to explore the use of web-based feedback to enhance transit performance. You, the employee of your transit agency, will be asked questions pertaining to current and future uses of web-based customer feedback tools within your agency. The final results of the survey will be incorporated into a report that will be published by the Transportation Research Board (TRB).

This is a web-based survey that should take 10 to 15 minutes to complete. Confidentiality is ensured by storing any personal information and responses in a secure server in our department to which only specific persons involved with this research would have access. The risks involved are no greater than those involved in daily activities.

You will not directly benefit or be compensated for joining this study. Study records will be kept confidential to the extent allowed by law. To make sure that this research is being carried out in the proper way, the Georgia Institute of Technology Institutional Review Board may review study records. The Office of Human Research Protections may also look at study records. Your participation in this study is voluntary. You have the right to leave the study at any time without giving any reason and without penalty.

If you have any questions about the study, you may contact Dr. Kari Watkins at telephone (404)385-4213, or kari.watkins@ce.gatech.edu. If you have any questions about your rights as a research subject, you may contact Ms. Melanie Clark, Georgia Institute of Technology at (404) 894-6942.

By checking the box below and clicking the 'Accept' button, you indicate your consent to participate in this research study. Please feel free to print this page for later reference.

Thank you for your participation.

☐ Check to consent.

Contact Information

Please enter your contact information. (Required fields are noted with an asterisk)

*Agency Name:_____

*City:_____

*State/Province:_____

Postal Code: _____

Country:_____

First Name: _____

Last Name:_____

Title:_____

Phone Number:_____

E-mail Address:_____

Tools for Obtaining Feedback

For the following and later questions, please use the definitions below. Note that for this study, we are only asking about customer feedback. Do not include information about your agency's use of web-based tools to distribute information, such as e-mail blasts or service updates via social media.

- E-mail – Customers send e-mail to the agency directly or via link on website. This does not include email blasts or other communications that originate with the agency.
- Online Surveys – An agency posts a questionnaire to a survey on its website or other online location for users to complete. Topics may include customer satisfaction, service alternatives, or other agency questions.
- Online Forms – Users can submit questions and comments to an agency typically through a webpage. Forms may be open-ended or include drop down menus or other options for users to structure their feedback.
- Online Feedback Panels – Agencies sponsor groups that are asked to comment about specific topics or respond to surveys. Groups are typically invitation-only and interact with the agency through a website or other online interface.
- Social Media – Users communicate with agency through social media channels, such as the agency's Facebook page, Twitter account, or official blog.
- Crowdsourcing – Agencies host online conversations where users can submit suggestions, other comments, and vote on their favorite idea. Agencies typically use third-party platforms such as SeeClickFix, IdeaScale, MindMixer, etc.
- Internet Forums – Users participate in online discussion sites where they can hold conversations in the form of posted messages, e.g. NYCtransitforums.com, transittalk.proboards.com. These are also known as online communities, bulletin boards, or message boards.
- Mobile Feedback – Users submit feedback or information to an agency using an application on a smart phone. Examples include mobile apps like See & Say where customers can alert agencies to safety and security issues.

1) Which of the following web-based customer feedback tools does your agency currently employ? (Select all that apply) **[Responses are used in Q5]**

E-mail	➔ If this is the only answer checked, skip to Q11-14, 17, 19, 20
Online surveys	➔ Skip to question 3
Online forms	➔ Skip to question 3
Online feedback panels	➔ Skip to question 3
Social media	➔ Skip to question 3
Crowdsourcing	➔ Continue to question 2
Internet forums	➔ Skip to question 3
Mobile feedback	➔ Continue to question 2
None	➔ If this is the only answer checked, skip to Q11-14, 17, 19, 20
Other Types of Feedback	➔ Skip to question 3

2) What specific mobile applications or third party media tools does your agency use to obtain feedback?

Please list_____

This survey is looking at two types of web-based feedback that an agency may receive: unsolicited and solicited. *Unsolicited* feedback does not respond to specific agency questions and includes all the comments, suggestions, complaints, and opinions that flow into the agency on a daily basis. *Solicited* feedback is structured by the agency that asks riders and the public to provide comment on specific topics of interest to the agency, such as service or fare changes, service quality or customer satisfaction. Please keep these definitions in mind for the following questions.

1) What categories of unsolicited feedback does your agency currently receive from its rider base? (Select all that apply).
   - ☐ Transit Service Operations
   - ☐ Safety and Security Issues
   - ☐ Maintenance Issues
   - ☐ Service Planning
   - ☐ Complaints and Commendations
   - ☐ Policy Changes
   - ☐ Budgets and Fares
   - ☐ Marketing and Promotions
   - ☐ Long range and Capital Planning
   - ☐ Other:_____
   - ☐ None

2) What categories of feedback does your agency actively solicit from its rider base? (Select all that apply.) **[Responses are used in Q5]**
   - ☐ Transit Service Operations
   - ☐ Safety and Security Issues
   - ☐ Maintenance Issues
   - ☐ Service Planning
   - ☐ Complaints and Commendations
   - ☐ Policy Changes
   - ☐ Budgets and Fares
   - ☐ Marketing and Promotions
   - ☐ Long range and Capital Planning
   - ☐ Other:_____
   - ☐ None ➔ Continue to question 6

3) Which web-based tools do you use to solicit customer feedback on <insert feedback topic from Question #4>

   [Pulls response choices from question #1]
   - ☐ E-mail
   - ☐ Online Surveys
   - ☐ Online Forms
   - ☐ Online Feedback Panels
   - ☐ Social Media
   - ☐ Crowdsourcing
   - ☐ Internet Forums
   - ☐ Mobile Feedback

Administration of Web-Based Customer Feedback Tools

4) What department in your agency has primary responsibility for initiating, implementing, and monitoring web-based customer feedback tools? (Select the response that best matches your agency)
   - ☐ Departments develop and implement their own web-based feedback tools
   - ☐ Responsibilities for web-based feedback tools are allocated to the relevant departments (Public Relations initiates, IT implements technology, customer service monitors, etc.)
   - ☐ Specific Department_____
   - ☐ Other_____

5) How is information from web-based customer feedback incorporated into agency operations and planning? (Select the option that best reflects your agency)

   - ☐ Comments are directed to the customer service department and treated the same as any other feedback
   - ☐ Comments are collected and handled by the department that established the feedback tool
   - ☐ Specific staff from throughout the agency are assigned to each web-based tool and respond or forward comments, as appropriate
   - ☐ A special department has been established specifically to develop, monitor, address and handle web-based customer feedback
   - ☐ Other_____

6) Which best describes the level of tracking and reporting of web-based customer feedback tools at your agency? (Select one)

   - ☐ We integrate web-based feedback into our existing customer feedback reporting systems (e.g. complaints or public comment databases)
   - ☐ We have separate tracking and reporting systems for our web-based customer feedback
   - ☐ We do not systematically track and report information from our web-based customer feedback tools
   - ☐ Other _____

7) Which best describes your agency's performance measurement activities to improve transit services? Performance measurement can include measures of economic efficiency, service effectiveness, and productivity.
   - ☐ We regularly monitor and report a broad range of agency performance measures, including customer feedback measures
   - ☐ We regularly monitor and report agency performance measures, but do not have customer feedback measures
   - ☐ We periodically measure performance, but do not have a regular performance measurement reporting program
   - ☐ We do not have a performance measurement and reporting program in place, but are anticipating developing such a program under the new federal MAP-21 legislation.
   - ☐ Other_____

Feedback from Transportation Disadvantaged Riders

Public transit agencies are required to provide services in a fair and equitable manner to all passengers without regard to their race, color or national origin, and must reduce language barriers that may impede access to important services by customers who may not be proficient in English. This extends to ensuring that transportation disadvantaged persons have equal opportunity to provide feedback on the full range of current and future transit services. Web-based customer feedback tools can assist in reaching out to these people.

8) What does your agency do to make your agency's web-based tools accessible to transportation disadvantaged and Title VI populations? (Select all that apply)
   - ☐ Closed captioning for audio and video clips
   - ☐ Special formatting to support screen reader use
   - ☐ Text-only tools/apps
   - ☐ Site translators
   - ☐ Variable text size
   - ☐ No special measures
   - ☐ Other_____

Rider Access to the Internet

9) What is your estimate of the percentage of your riders that have internet access?

	0-20%	*21-40%*	*41-60%*	*61-80%*	*81-100%*	*Don't Know*
Percentage of Riders with Internet Access						

10) What is the source of this estimate?
- ☐ Agency survey
- ☐ Local estimates of internet access in my area
- ☐ Staff estimate based on knowledge of our customer base
- ☐ Other_____

11) What is your estimate of the percentage of your riders that have smart phones?

	0-20%	*21-40%*	*41-60%*	*61-80%*	*81-100%*	*Don't Know*
Percentage of Riders with Smart Phones						

12) What is the source of this estimate?
- ☐ Agency survey
- ☐ Local estimates of Smart Phone access in my area
- ☐ Staff estimate based on knowledge of our customer base
- ☐ Other _____

Benefits and Drawbacks of Web-based Feedback

13) What are the benefits to your agency for using web-based feedback tools? (Select all that apply)

- ☐ Cost effectively collects customer feedback (Less data entry, easy data retrieval)
- ☐ Provides specific actionable information
- ☐ Real time information allows timely interaction with customers
- ☐ Allows interaction with tech savvy riders
- ☐ Enhances agency image (innovative, customer-oriented, engaged with riders)
- ☐ Improves ability of special populations to provide feedback
- ☐ Increases opportunities for all customers to provide positive feedback
- ☐ Easy to implement quickly (no procurement)
- ☐ Other_____

14) What are the drawbacks to your agency with the **existing** web-based feedback tools? (Select all that apply)

- ☐ Potential negative feedback could affect agency image
- ☐ Lack of staff to respond to comments in a timely manner
- ☐ Lack of support from senior managers for web-based tools
- ☐ Most of our riders don't use the internet or have smart phones
- ☐ No process in place for handling feedback
- ☐ Our agency limits employee access to the internet
- ☐ Security risks/cyber security concerns
- ☐ Difficult to comply with archiving, record keeping, and other requirements
- ☐ Other_____

15) What is **preventing** your agency from adding web-based feedback tools? (Select all that apply)

- ☐ Lack of demand from riders for web-based tools
- ☐ Lack of management support for web-based activities
- ☐ Lack of staff understanding of, and training on web-based feedback tools
- ☐ Lack of staff resources to develop, implement, and maintain the tools
- ☐ Data security and privacy concerns
- ☐ Does not apply – nothing is preventing us
- ☐ Other_____

16) What is the approximate level of staff resources (across all departments) used to support web-based customer feedback activities?

Approximate FTEs (Full-Time Equivalent Employees): _____

Future of Web-based Feedback Systems

17) How do you anticipate your use of the following web-based tools will change over the next five years?

	Use More	*Stay the Same*	*Use Less*	*Stop Using*	*Will Start Using*	*Will Not Implement*	*Don't Know*
Online Surveys							
Online forms							
Online Feedback Panels							
Social Media							
Crowdsourcing							
Internet Forums							
Mobile Feedback							

Final Comments

18) Image for a minute the ideal web-based customer feedback system for your agency. What would your agency like to see? How would it operate? What type of feedback would you receive?

Please describe your desired system:_____

19) Do you have any lessons learned which would benefit other transit agencies that are considering implementing web-based customer feedback tools?

What is the most important lesson: _____

Thank You!

Thank you for taking our survey. Your response is very important to us.

Appendix B: Transit Agency Size and Urbanized Area Categories

Categorized By Annual Unlinked Trips

Large Transit Agencies (over 20 million annual unlinked trips)

Agency Name	City	State/Province
City of Phoenix Public Transit Department	Phoenix	AZ
Valley Metro	Phoenix	AZ
AC Transit	Oakland	CA
BART	Oakland	CA
Long beach Transit	Long Beach	CA
Los Angeles County Metropolitan Transportation Authority	Los Angeles	CA
Metropolitan Transit System	San Diego	CA
Orange County Transportation Authority	Orange	CA
Santa Clara Valley Transportation Authority	San Jose	CA
SF Municipal Transportation Agency	San Francisco	CA
RTD	Denver	CO
Washington Metropolitan Transit Authority	Washington	DC
Broward County Transit	Plantation	FL
LYNX	Orlando	FL
Miami-Dade Transit	Miami	FL
MARTA	Atlanta	GA
City and County of Honolulu Department of Transportation Services	Honolulu	HI
Chicago Transit Authority	Chicago	IL
Pace Suburban Bus	Arlington Heights	IL
Cape Ann Transportation	Gloucester	MA
MBTA	Boston	MA
Bi-State Development Agency	St. Louis	MO
Charlotte Area Transit System	Charlotte	NC
MTA	New York	NY
Port Authority of NY & NJ	New York	NY
Westchester County Department of Public Works and Transportation	Mount Vernon	NY
GCRTA	Cleveland	OH
TriMet	Portland	OR
Port Authority of Allegheny County	Pittsburgh	PA
SEPTA	Philadelphia	PA
Capital Metro	Austin	TX
Dallas Area Rapid Transit	Dallas	TX
VIA Metropolitan Transit	San Antonio	TX
Utah Transit Authority	Salt Lake City	UT
King County Metro Transit	Seattle	WA
Sound Transit	Seattle	WA
Milwaukee County Transit System	Milwaukee	WI

Medium Transit Agencies (200,000 to 500,000 annual unlinked trips)

Agency Name	City	State/Province
Public Transportation Department	Municipality of Anchorage	AK
City of Fresno Department of Transportation - Fresno Area Express	Fresno	CA
Eastern Contra Costa Transit Authority	Antioch	CA
Foothill Transit	West Covina	CA
Golden Gate Bridge, Highway and Transportation District	San Rafael	CA
Marin Transit	San Rafael	CA
North County Transit District	Oceanside	CA
Riverside Transit Agency	Riverside	CA
Mountain Metropolitan Transit	Colorado Springs	CO
Delaware Transit Corporation	Wilmington	DE
HART	Tampa	FL
Pinellas Suncoast Transit Authority (PSTA)	St. Petersburg	FL
Regional Transit System	Gainesville	FL
South Florida Regional Transportation Authority	Pompano Beach	FL
Ames Transit Agency	Ames	IA
Des Moines Area Regional Transit Authority	Des Moines	IA
The University of Iowa - Cambus	Iowa City	IA
Champaign-Urbana Mass Transit District	Urbana	IL
QC MetroLINK	Moline	IL
Transit Authority of River City	Louisville	KY
Ann Arbor Transportation Authority	Ann Arbor	MI
Capital Area Transportation Authority	Lansing	MI
The Rapid	Grand Rapids	MI
Columbia Transit	Columbia	MO
KCATA	Kansas City	MO
NC State University	Raleigh	NC
Albuquerque Transit Department	Albuquerque	NM
Regional Transportation Commission of Washoe County	Reno	NV
CDTA	Albany	NY
TCAT	Ithaca	NY
COTA	Columbus	OH
Greater Dayton RTA	Dayton	OH
Metro	Cincinnati	OH
METRO RTA	Akron	OH
Southwest Ohio Regional Transit Authority/Metro	Cincinnati	OH
Toledo Area Regional Transit Authority	Toledo	OH
COTPA	Oklahoma City	OK
Lane Transit District	Eugene	OR
Centre Area Transportation Authority	State College	PA

Agence Metropolitaine de Transport	Montreal	Quebec
RIPTA	Providence	RI
Knoxville Area Transit	Knoxville	TN
Nashville MTA & Regional Transportation Authority	Nashville	TN
Denton County Transportation Authority	Lewisville	TX
Fort Worth Transportation Authority	Fort Worth	TX
Sun Metro	El Paso	TX
Ben Franklin Transit	Richland	WA
Community Transit	Everett	WA
Intercity Transit	Olympia	WA
Pierce Transit	Lakewood	WA

Small Transit Agencies (Under 200,000 annual unlinked trips)

Agency Name	City	State/Province
Northern Arizona Intergovernmental Public Transportation Authority	Flagstaff	AZ
Sun Tran	Tucson	AZ
City of Corona	Corona	CA
City of Petaluma - Petaluma Transit	Petaluma	CA
City of Redondo Beach	Redondo Beach	CA
Commerce Municipal Bus Lines	Commerce	CA
Porterville Transit	City of Porterville	CA
San Luis Obispo Transit Authority	San Luis Obispo	CA
SLO RTA	San Luis Obispo	CA
Ventura County Transportation Commission	Ventura	CA
Greeley Evans Transit	Greeley	CO
Hall Area Transit	Gainesville	GA
City of Bettendorf	Bettendorf	IA
City of Davenport	Davenport	IA
Coralville Transit	Coralville	IA
Johnson County SEATS	Iowa City	IA
Metropolitan Transit Authority of B.H.C.	Waterloo	IA
Danville Mass Transit	Danville	IL
Muncie Indiana Transit System	Muncie	IN
Topeka Metro	Topeka	KS
GO bg Transit	Bowling Green	KY
Central Maryland Regional Transit	Laurel	MD
Community Connector	Bangor	ME
Greater Portland Transit District	Portland	ME
Mecosta Osceola Transit Authority	Big Rapids	MI
MATBUS	Moorhead	MN

St. Joseph Transit	St. Joseph	MO
City of Billings - MET Transit	Billings	MT
Town of Cary	Cary	NC
Triangle Transit	Durham	NC
Cities Area Transit	Grand Forks	ND
MATBUS	City of Fargo	ND
Santa Fe Trails	Santa Fe	NM
City of Corvallis	Corvallis	OR
SMART Transit	Wilsonville	OR
Cambria County Transit Authority	Johnstown	PA
Rapid Transit System	Rapid City	SD
Arlington County	Arlington	VA
Harrisonburg Department of Public Transportation	Harrisonburg	VA
Petersburg Area Transit	Petersburg	VA
Beloit Transit System	Beloit	WI
Metro Ride	Wausau	WI
Cheyenne Transit Program	Cheyenne	WY

Categorized By Size of UZA

Large UZAs (population over 500,000)

Agency Name (Large)	City	State/ Province
City of Phoenix Public Transit Department	Phoenix	AZ
Sun Tran	Tucson	AZ
Valley Metro	Phoenix	AZ
AC Transit	Oakland	CA
BART	Oakland	CA
City of Corona	Corona	CA
City of Fresno Department of Transportation - Fresno Area Express	Fresno	CA
City of Redondo Beach	Redondo Beach	CA
Commerce Municipal Bus Lines	Commerce	CA
Foothill Transit	West Covina	CA
Golden Gate Bridge, Highway and Transportation District	San Rafael	CA
Long beach Transit	Long Beach	CA
Los Angeles County Metropolitan Transportation Authority	Los Angeles	CA
Marin Transit	San Rafael	CA
Metropolitan Transit System	San Diego	CA
North County Transit District	Oceanside	CA
Orange County Transportation Authority	Orange	CA
Riverside Transit Agency	Riverside	CA
Santa Clara Valley Transportation Authority	San Jose	CA
SF Municipal Transportation Agency	San Francisco	CA
RTD	Denver	CO
Washington Metropolitan Transit Authority	Washington	DC
Delaware Transit Corporation	Wilmington	DE
Broward County Transit	Plantation	FL
HART	Tampa	FL
LYNX	Orlando	FL
Miami-Dade Transit	Miami	FL
Pinellas Suncoast Transit Authority (PSTA)	St. Petersburg	FL
South Florida Regional Transportation Authority	Pompano Beach	FL
MARTA	Atlanta	GA
City and County of Honolulu Department of Transportation Services	Honolulu	HI
Chicago Transit Authority	Chicago	IL
Pace Suburban Bus	Arlington Heights	IL
Transit Authority of River City	Louisville	KY
Cape Ann Transportation	Gloucester	MA
MBTA	Boston	MA

Agency Name (Large)	City	State/ Province
Central Maryland Regional Transit	Laurel	MD
The Rapid	Grand Rapids	MI
Bi-State Development Agency	St. Louis	MO
KCATA	Kansas City	MO
Charlotte Area Transit System	Charlotte	NC
NC State University	Raleigh	NC
Town of Cary	Cary	NC
Albuquerque Transit Department	Albuquerque	NM
CDTA	Albany	NY
MTA	New York	NY
Port Authority of NY & NJ	New York	NY
Westchester County Department of Public Works and Transportation	Mount Vernon	NY
COTA	Columbus	OH
GCRTA	Cleveland	OH
Greater Dayton RTA	Dayton	OH
Metro	Cincinnati	OH
METRO RTA	Akron	OH
Southwest Ohio Regional Transit Authority/Metro	Cincinnati	OH
Toledo Area Regional Transit Authority	Toledo	OH
COTPA	Oklahoma City	OK
SMART Transit	Wilsonville	OR
TriMet	Portland	OR
Port Authority of Allegheny County	Pittsburgh	PA
SEPTA	Philadelphia	PA
Agence Metropolitaine de Transport	Montreal	Quebec
RIPTA	Providence	RI
Nashville MTA & Regional Transportation Authority	Nashville	TN
Capital Metro	Austin	TX
Dallas Area Rapid Transit	Dallas	TX
Fort Worth Transportation Authority	Fort Worth	TX
Sun Metro	El Paso	TX
VIA Metropolitan Transit	San Antonio	TX
Utah Transit Authority	Salt Lake City	UT
Arlington County	Arlington	VA
Petersburg Area Transit	Petersburg	VA
Community Transit	Everett	WA
King County Metro Transit	Seattle	WA
Pierce Transit	Lakewood	WA
Sound Transit	Seattle	WA
Milwaukee County Transit System	Milwaukee	WI

Medium UZAs (population between 200,000 and 500,000)

Agency Name (Medium)	City	State/ Province
Public Transportation Department	Municipality of Anchorage	AK
Eastern Contra Costa Transit Authority	Antioch	CA
Ventura County Transportation Commission	Ventura	CA
Mountain Metropolitan Transit	Colorado Springs	CO
City of Bettendorf	Bettendorf	IA
City of Davenport	Davenport	IA
Des Moines Area Regional Transit Authority	Des Moines	IA
QC MetroLINK	Moline	IL
Ann Arbor Transportation Authority	Ann Arbor	MI
Triangle Transit	Durham	NC
Regional Transportation Commission of Washoe County	Reno	NV
Lane Transit District	Eugene	OR
Knoxville Area Transit	Knoxville	TN
Denton County Transportation Authority	Lewisville	TX

Small UZAs (population under 200,000)

Agency Name (Small)	City	State/ Province
Northern Arizona Intergovernmental Public Transportation Authority	Flagstaff	AZ
City of Petaluma - Petaluma Transit	Petaluma	CA
Porterville Transit	City of Porterville	CA
San Luis Obispo Transit Authority	San Luis Obispo	CA
SLO RTA	San Luis Obispo	CA
Greeley Evans Transit	Greeley	CO
Regional Transit System	Gainesville	FL
Hall Area Transit	Gainesville	GA
Ames Transit Agency	Ames	IA
Coralville Transit	Coralville	IA
Johnson County SEATS	Iowa City	IA
Metropolitan Transit Authority of B.H.C.	Waterloo	IA
The University of Iowa - Cambus	Iowa City	IA
Champaign-Urbana Mass Transit District	Urbana	IL
Danville Mass Transit	Danville	IL
Muncie Indiana Transit System	Muncie	IN
Topeka Metro	Topeka	KS
GO bg Transit	Bowling Green	KY
Community Connector	Bangor	ME

Greater Portland Transit District	Portland	ME
Capital Area Transportation Authority	Lansing	MI
Mecosta Osceola Transit Authority	Big Rapids	MI
MATBUS	Moorhead	MN
Columbia Transit	Columbia	MO
St. Joseph Transit	St. Joseph	MO
City of Billings - MET Transit	Billings	MT
Cities Area Transit	Grand Forks	ND
MATBUS	City of Fargo	ND
Santa Fe Trails	Santa Fe	NM
TCAT	Ithaca	NY
City of Corvallis	Corvallis	OR
Cambria County Transit Authority	Johnstown	PA
Centre Area Transportation Authority	State College	PA
Rapid Transit System	Rapid City	SD
Harrisonburg Department of Public Transportation	Harrisonburg	VA
Ben Franklin Transit	Richland	WA
Intercity Transit	Olympia	WA
Beloit Transit System	Beloit	WI
Metro Ride	Wausau	WI
Cheyenne Transit Program	Cheyenne	WY

Appendix C: Transit Agency Internet/Smartphone Access Responses

Transit Agency Internet Access Responses

State	State Response	Agency Size	City	Agency Name	Agency Reporting
Alaska	Higher	Medium	Anchorage	Public Transportation Department	Less
Arizona	Same	Large	Phoenix	City of Phoenix Public Transi Dept.	Less
		Small	Flagstaff	Northern Arizona Intergovernmental Public Transportation Authority	Less
		Small	Tucson	Sun Tran	Less
		Large	Phoenix	Valley Metro	More or Equal
Califonia	Higher	Large	Oakland	BART	More or Equal
		Medium	Fresno	City of Fresno Department of Transportation/Fresno Area Express	Less
		Small	Petaluma	City of Petaluma- Petaluma Transit	Less
		Small	Commerce	Commerce Municipal Bus Lines	Less
		Medium	Antioch	Eastern Contra Costa Transit Authority	Less
		Medium	West Covina	Foothill Transit	Less
		Large	Long Beach	Long beach Transit	More or Equal
		Large	Los Angeles	Los Angeles County Metropolitan Transportation Authority	Less
		Medium	San Rafael	Marin Transit	More or Equal
		Large	Orange	Orange County Transportation Authority	Less
		Small	Porterville	Porterville Transit	Less
		Small	San Luis Obsipo	San Luis Obispo Transit Authority	More or Equal
		Small	San Luis Obispo	SLO RTA	Less
		Small	Ventura	Ventura County Transportation Commission (VCTC)	Less
Colorado	Higher	Small	Greeley	Greeley Evans Transit	Less
		Medium	Colorado Springs	Mountain Metropolitan Transit	Less
		Large	Denver	RTD	Less
Delaware	Below	Medium	Wilmington	Delaware Transit Corporation	Less

D.C.	Higher	Large	Washington	Washington Metropolitan Transit Authority	Less
Florida	Same	Large	Plantation	Broward County Transit	Less
		Medium	Tampa	HART	Less
		Large	Orlando	LYNX	Less
		Large	Miami	Miami-Dade Transit	Less
		Medium	Gainesville	Regional Transit System (RTS)	Less
Hawaii	Same	Large	Honolulu	City and County of Honolulu Department of Transportation Services	More or Equal
Illinois	Same	Medium	Urbana	Champaign-Urbana Mass Transit District	More or Equal
		Small	Danville	Danville Mass Transit	Less
		Large	Arlington Heights	Pace Suburban Bus	More or Equal
		Medium	Moline	QC MetroLINK	Less
Indiana	Below	Small	Muncie	Muncie Indiana Transit System	Less
Iowa	Same	Medium	Ames	Ames Transit Agency	More or Equal
		Medium	Des Moines	Des Moines Area Regional Transit Authority	Less
		Small	Iowa City	Johnson County SEATS	Less
		Small	Waterloo	Metropolitan Transit Authority of B.H.C.	Less
		Medium	Iowa City	The University of Iowa - Cambus	More or Equal
Kentucky	Below	Small	Bowling Green	GO bg transit	Less
Maine	Same	Small	Bangor	Community Connector	Less
		Small	Portland	Greater Portland Transit District	Less
Massachusetts	Same	Large	Boston	MBTA	Less
Michigan	Same	Medium	Ann Arbor	Ann Arbor Transportation Authority	Less
		Small	Big Rapids	Mecosta Osceola Transit Authority	Less
		Medium	Grand Rapids	The Rapid	Less
Minnesota	Higher	Small	Moorhead	MATBUS	Less
Missouri	Same	Large	St. Louis	Bi-State Development Agency (dba Metro)	More or Equal

		Medium	Columbia	Columbia Transit	Less
		Medium	Kansas City	KCATA	More or Equal
		Small	St. Joseph	St. Joseph Transit	Less
Montana	Below	Small	Billings	City of Billings - MET Transit	More or Equal
Nevada	Same	Medium	Reno	Regional Transportation Commission of Washoe County	Less
New York	Below	Medium	Albany	CDTA	Less
		Large	New York	MTA	Less
		Large	New York	Port Authority of NY & NJ	More or Equal
		Medium	Ithaca	TCAT	More or Equal
		Large	Mount Vernon	Westchester County Department of Public Works and Transportation	Less
North Carolina	Below	Large	Charlotte	Charlotte Area Transit System	Less
		Medium	Raleigh	NC State University	More or Equal
		Small	Durham	Triangle Transit	More or Equal
North Dakota	Same	Small	Grand Forks	Cities Area Transit	Less
		Small	Fargo	MATBUS	Less
Ohio	Below	Medium	Columbus	COTA	More or Equal
		Large	Cleveland	GCRTA	Less
		Medium	Dayton	Greater Dayton RTA	More or Equal
		Medium	Cincinnati	Metro	Less
		Medium	Akron	METRO RTA	Less
		Medium	Cincinnati	Southwest Ohio Regional Transit Authority/Metro	Less
Oklahoma	Below	Medium	Oklahoma City	COTPA	Less
Oregon	Higher	Small	Corvallis	City of Corvallis	Less
		Medium	Eugene	Lane Transit District	Less
		Small	Wilsonville	SMART Transit	More or Equal
Pennsylvania	Below	Small	Johnstown	Cambria County Transit Authority	Less

		Medium	State College	Centre Area Transportation Authority (CATA)	More or Equal
		Large	Philadelphia	SEPTA	Less
Rhode Island	Same	Medium	Providence	RIPTA	Less
South Dakota	Same	Small	Rapid City	Rapid Transit System	Less
Tennessee	Below	Medium	Nashville	Nashville MTA & Regional Transportation Authority	Less
Texas	Same	Large	Austin	Capital Metro	More or Equal
		Large	Dallas	Dallas Area Rapid Transit	More or Equal
		Medium	Lewisville	Denton County Transportation Authority	Less
		Medium	Fort Worth	Fort Worth Transportation Authority	Less
		Large	San Antonio	VIA Metropolitan Transit	Less
Utah	Same	Large	Salt Lake City	Utah Transit Authority	More or Equal
Virginia	Same	Small	Harrisonburg	Harrisonburg Department of Public Transportation	More or Equal
		Small	Petersburg	Petersburg Area Transit	Less
Washington	Higher	Medium	Richland	Ben Franklin Transit	Less
		Medium	Lakewood	Pierce Transit	Less
		Large	Seattle	Sound Transit	Less
Wisconsin	Same	Small	Beloit	Beloit Transit System	Less
		Small	Wausau	Metro Ride	Less
		Large	Milwaukee	Milwaukee County Transit System	Less
Wyoming	Same	Small	Cheyenne	Cheyenne Transit Program	Less

Transit Agency Smartphone Access Responses

State	State Response	Agency Size	City	Agency Name	Agency Reporting
Arizona	Same	Large	Phoenix	City of Phoenix Public Transit Dept.	Less
		Small	Tucson	Sun Tran	More
		Large	Phoenix	Valley Metro	Equal
California	Higher	Small	Corona	City of Corona	Less

		Small	Petaluma	City of Petaluma- Petaluma Transit	More
		Medium	San Rafael	Golden Gate Bridge, Highway and Transportation District	More
		Large	Long Beach	Long beach Transit	More
		Medium	Oceanside	North County Transit District	Equal
		Large	Oakland	AC Transit	More
		Medium	Fresno	City of Fresno Department of Transportation/Fresno Area Express	Less
		Small	Commerce	Commerce Municipal Bus Lines	Less
		Medium	San Rafael	Marin Transit	More
		Large	San Diego	Metropolitan Transit System	Equal
		Large	Orange	Orange County Transportation Authority	Less
		Medium	Riverside	Riverside Transit Agency	Equal
		Small	San Luis Obsipo	San Luis Obispo Transit Authority	More
		Large	San Francisco	SF Municipal Transportation Agency	Less
		Small	Ventura	Ventura County Transportation Commission (VCTC)	More
Colorado	Higher	Medium	Colorado Springs	Mountain Metropolitan Transit	Less
		Large	Denver	RTD	Equal
Florida	Below	Medium	Tampa	HART	Less
		Large	Plantation	Broward County Transit	More
		Medium	Gainesville	Regional Transit System (RTS)	Less
		Large	Orlando	LYNX	Equal
		Medium	Pompano Beach	South Florida Regional Transportation Authority	Less
Georgia	Higher	Small	Gainesville	Hall Area Transit	Equal
		Large	Atlanta	MARTA	More
Hawaii	Below	Large	Honolulu	City and County of Honolulu Department of Transportation Services	Less
Illinois	Below	Small	Danville	Danville Mass Transit	More
		Large	Arlington Heights	Pace Suburban Bus	More
		Medium	Moline	QC MetroLINK	Equal
		Medium	Urbana	Champaign-Urbana Mass Transit District	Equal

		Large	Chicago	Chicago Transit Authority	Equal
Indiana	Below	Small	Muncie	Muncie Indiana Transit System	Equal
Iowa	Higher	Small	Davenport	City of Davenport	More
		Medium	Ames	Ames Transit Agency	Less
		Small	Coralville	Coralville Transit	Less
		Medium	Des Moines	Des Moines Area Regional Transit Authority	Equal
		Small	Iowa City	Johnson County SEATS	Less
		Small	Waterloo	Metropolitan Transit Authority of B.H.C.	More
		Medium	Iowa City	The University of Iowa - Cambus	Equal
Kentucky	Below	Medium	Louisville	Transit Authority of River City	Less
		Small	Bowling Green	GO bg transit	Less
Maine	Below	Small	Bangor	Community Connector	Less
Maryland	Same	Small	Laurel	Central Maryland Regional Transit	More
Massachusetts	Higher	Large	Gloucester	Cape Ann Transportation	More
		Large	Boston	MBTA	Equal
Michigan	Below	Medium	Ann Arbor	Ann Arbor Transportation Authority	Equal
		Medium	Lansing	Capital Area Transportation Authority	Less
		Medium	Grand Rapids	The Rapid	More
Minnesota	Higher	Small	Moorhead	MATBUS	Equal
Missouri	Same	Large	St. Louis	Bi-State Development Agency (dba Metro)	More
		Medium	Columbia	Columbia Transit	Equal
		Medium	Kansas City	KCATA	Equal
		Small	St. Joseph	St. Joseph Transit	Less
Montana	Same	Small	Billings	City of Billings - MET Transit	More
Nevada	Same	Medium	Reno	Regional Transportation Commission of Washoe County	Less
New Mexico	Below	Medium	Albuquerque	Albuquerque Transit Department	Less
		Small	Santa Fe	Santa Fe Trails	Less
New York	Below	Large	Mount Vernon	Westchester County Department of Public Works and Transportation	More

		Large	New York	Port Authority of NY & NJ	More
		Medium	Albany	CDTA	Less
		Large	New York	MTA	Equal
		Medium	Ithaca	TCAT	More
North Carolina	Below	Small	Cary	Town of Cary	Less
		Small	Durham	Triangle Transit	Equal
		Large	Charlotte	Charlotte Area Transit System	More
North Dakota	Higher	Small	Grand Forks	Cities Area Transit	More
Ohio	Below	Large	Cleveland	GCRTA	More
		Medium	Cincinnati	Metro	Less
		Medium	Toledo	Toledo Area Regional Transit Authority	More
		Medium	Columbus	COTA	Less
Oklahoma	Same	Medium	Oklahoma City	COTPA	Less
Oregon	Higher	Medium	Eugene	Lane Transit District	Less
		Small	Corvallis	City of Corvallis	More
		Small	Wilsonville	SMART Transit	Equal
Pennsylvania	Below	Small	Johnstown	Cambria County Transit Authority	Less
		Large	Philadelphia	SEPTA	Equal
		Medium	State College	Centre Area Transportation Authority (CATA)	Equal
Rhode Island	Same	Medium	Providence	RIPTA	Equal
South Dakota	Higher	Small	Rapid City	Rapid Transit System	Equal
Tennessee	Below	Medium	Nashville	Nashville MTA & Regional Transportation Authority	More
		Medium	Knoxville	Knoxville Area Transit	Equal
Texas	Higher	Medium	Lewisville	Denton County Transportation Authority	Less
		Large	Dallas	Dallas Area Rapid Transit	Equal
		Medium	El Paso	Sun Metro	Less
Virginia	Below	Small	Harrisonburg	Harrisonburg Department of Public Transportation	More
		Small	Arlington	Arlington County	More

Washington	Higher	Medium	Lakewood	Pierce Transit	More
		Large	Seattle	Sound Transit	More
		Medium	Olympia	Intercity Transit	Equal
Wisconsin	Same	Small	Wausau	Metro Ride	Equal
		Large	Milwaukee	Milwaukee County Transit System	More

Appendix D: Statistical Tests

Chi-Square Test of Independence – Agency Size versus Mobile Applications

		Use Mobile Applications		
		No	Yes	Total
Agency Size	Large Agency	18.5%	10.0%	28.5%
	Medium Agency	36.2%	2.3%	38.5%
	Small Agency	31.5%	1.5%	33.1%
Total %		86.2%	13.8%	100.0%

Chi square test of independence $x^2 = 19.686, 2\ d.f.$, p < .0001

Chi-Square Test of Independence – Smartphone Access versus Mobile Applications

		Use Mobile Applications		
		No	Yes	Total
Rider Access to Smartphones	0-20%	8.5%	.0%	8.5%
	21-40%	22.3%	3.2%	25.5%
	41-60%	24.5%	6.4%	30.9%
	61-80%	24.5%	5.3%	29.8%
	81-100%	4.3%	1.1%	5.3%
Total %		84.0%	16.0%	100.0%

Chi square test of independence $x^2 = 2.353, 4\ d.f.$, p > .05

Chi-Square Test of Independence – Internet Access versus Agency Size

		Estimated Rider Internet Access					
		0-20%	21-40%	41-60%	61-80%	81-100%	Total
Agency Size	Large Agency	0%	1%	1%	15%	10%	27%
	Medium Agency	0%	5%	5%	15%	10%	40%
	Small Agency	4%	5%	6%	11%	5%	33%
Total %		4%	11%	12%	41%	25%	100.0%

Chi square test of independence $x^2 = 19.349, 10\ d.f.$, $p < .05$

Chi-Square Test of Independence – Smartphone Access versus Agency Size

		Estimated Rider Smartphone Access					
		0-20%	21-40%	41-60%	61-80%	81-100%	Total
Agency Size	Large Agency	0%	8%	9%	12%	1%	30%
	Medium Agency	2%	9%	11%	12%	4%	38%
	Small Agency	6%	9%	12%	5%	0%	32%
Total %		8%	26%	32%	29%	5%	100.0%

Chi square test of independence $x^2 = 15.506, 8\ d.f.$, $p < .05$

Factorial Regression - Dependent Variable Number of Tools Used

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.024	.516	-	5.860	.000
	Small Agency	-.709	.355	-.244	-1.995	.049
	Medium Agency	-.435	.302	-.172	-1.438	.154
	Large Agency	BASE CASE				
	Number of Associated Drawbacks	.174	.108	.162	1.618	.109
	Number of Associated Benefits	.131	.065	.203	2.031	.045
	Approximate Full Time Employees Required	.012	.007	.172	1.679	.097

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.689	5	6.138	4.583	.001[a]
	Residual	113.839	85	1.339		
	Total	144.527	90			

Factorial Regression – Dependent Variable Number of Tools Used

Associated Drawbacks		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.276	.312	-	10.492	.000
	Potential Negative Feedback	.050	.309	.016	.160	.873
	Lack of Staff	.329	.316	.103	1.043	.300
	Lack of Management Support	.477	.491	.101	.972	.334
	Most of our Riders Don't Have Internet/Smartphones	-.997	.414	-.230	-2.410	.018
	No Process for Handling Feedback	.514	.432	.122	1.191	.237
	Our Agency Limits Employee Access to Internet	.837	.527	.165	1.588	.116
	Security Risks	.524	.403	.127	1.300	.197
	Difficult to Comply with Requirements for Storage	-.296	.330	-.091	-.897	.372

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.304	8	4.538	2.037	.050[a]
	Residual	218.324	98	2.228		
	Total	254.628	106			

Factorial Regression – Dependent Variable Number of Tools Used

Associated Benefits		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.284	.631	-	3.619	.000
	Easy to Implement	.173	.346	.053	.498	.619
	Cost Effective	.535	.413	.135	1.294	.199
	Provides Actionable Data	.460	.340	.142	1.352	.179
	Real Time Info Allows Timely Responses	.269	.381	.074	.707	.481
	Allows Interaction with Tech Savvy Riders	-.168	.342	-.053	-.491	.624
	Enhances Agency Image	.272	.435	.066	.625	.534
	Improves Connection with Special Populations	.107	.330	.035	.324	.747
	Increases Feedback Provision for All Riders	.068	.520	.012	.130	.897

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.142	8	3.143	1.340	.232[a]
	Residual	243.899	104	2.345		
	Total	269.040	112			

Factorial Regression – Dependent Variable "Most of our Riders Don't have Access to Internet/Smartphones

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.805	.201	-	4.012	.000
	Small Agency	.206	.100	.257	2.059	.043
	Medium Agency	-.054	.085	-.074	-.629	.531
	Large Agency	Base Case				
	Rider Internet Access	-.110	.033	-.344	-3.304	.001
	Rider Smartphone Access	-.077	.037	-.222	-2.075	.042
	Number of Tools Used	-.010	.032	-.037	-.307	.760
	Mobile Apps	-.015	.108	-.016	-.135	.893

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.254	6	.709	8.534	.000[a]
	Residual	5.899	71	.083		
	Total	10.154	77			

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